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THE UTILITY OF FLUOROGRAPHY

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THE present technic of fluorography, or photography of the fluoroscopic image, is the result of a gradual development of the method which dates back to the period of hectic experimentation immediately following the announcement of Roentgen's discovery. The ingenuity then shown in the efforts to establish the best method of recording the x-ray image was extraordinary.

The screen image, simple and easy in its attainment, instantaneous in its appearance, graphic in its visibility seemed, for the moment, to be the most desirable and it was only logical to attempt to obtain a permanent record of this image by ordinary photography. In three laboratories in different parts of the world, efforts were directed, at practically the same time, toward photographing the shadows on a fluorescent screen by means of an ordinary camera. Thus, soon after Roentgen's discovery, Bleyer constructed and used an apparatus for photographing the fluorescent image which he called the "photofluoroscope." Bleyer thought the method had an advantage over the direct film record in that visual observation could be combined with the production of a permanent record, at that time obtainable by a photographic exposure of a few minutes. Battelli and Garbasso also experimented with this idea and published their preliminary results in the January, 1896, issue of *Il Nuovo Cimento*. Their first attempts resulted in the production on the camera plate of only the image of the metallic holder of the lens because the x-rays penetrated the fluorescent screen and the plate holder of the photographic camera and darkened the plate before the faint light of the fluorescent screen could make an impression. However, by placing a heavy lead diaphragm with a hole the size of a lens in front of the camera, the shadows on the screen could be photographically recorded with clarity.

In the same year, McIntyre was the first to attempt to make a series of successive pictures of a moving object. First, he made single exposures which he arranged on a moving picture film, but later he photographed the moving image directly with a moving picture camera and demonstrated to the Glasgow Philosophical Society (November, 1896), with a cinematographic projector, forty feet of film showing the movements of the leg of a frog.

But when Porcher (1897), after considerable experimentation, discarded the method as impractical and as having no advantage whatever over direct contact roentgenography, he apparently expressed the opinion of most workers, for the method of fluorophotography was abandoned in favor of the direct roentgenography which developed with remarkable strides from its crude beginnings to its present highly developed state.

The still photography of the fluorescent image was, however, revived by Köhler (1907) in his efforts to obtain a better cinematographic record of the screen image. In association with Biesalski (1909), a practical method of photographing the image was described. The screen was of tungstate of calcium, the camera had an F 2 lens, and a mirror was so arranged as to permit placing the camera outside of the beam of direct radiation.

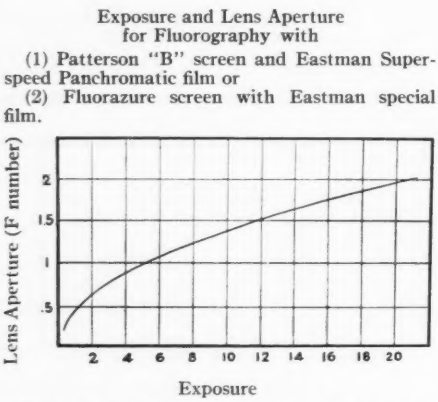

Fig. 1. Graph showing the relationship between "x-ray quantity" and lens aperture.

It was apparent that the future of the method depended on the possibility of obtaining lenses of greater aperture, screens of more brilliant luminescence, and photographic films of higher sensitivity.

In 1911, Caldwell presented all the basic and essential principles underlying the application of photography of the fluoroscopic image and foreshadowed its present-day application with prophetic and scientific acumen.

The great improvement in recent years in fluorescent screens, in photographic material, and in lens construction is responsible for the development of the method to such a state that its practical and routine application is now possible.

De Abreu's work (Brazil), in 1930, represents the first large scale application of the method. In fact, modern fluorography owes its present status to his ingenuity and enthusiasm. Many technical improvements have been devised by Janker (1938).

The Lens.—The image produced by a lens always possesses defects which, unless corrected, result in unsharpness and distortion. The task of the lens designer is the production of a lens in which the defects have been corrected to a sufficient degree to permit sharp and true image formation. It is more difficult to produce a corrected lens for a large picture than for a small one. It is, likewise, more difficult to produce a corrected lens of high speed (light-gathering power) than one of low speed.

The size of picture is expressed by the term "coverage." The light-gathering power or speed is expressed by the "*F*" number, which is the ratio of the focal length to the effective diameter of the lens. A low "*F*" number indicates high speed.

The relation between exposure (x-ray quantity) and lens aperture ("*F*" number) is shown in Figure 1.

The difficulty of designing and constructing lenses of sufficient coverage and high speed is apparent from Table I, showing the limited number of such lenses available.

The combination of high speed and fine correction of a lens involves the use of a large number of separate glass elements. For example, in the F 1.5 Zeiss Sonnar lens, now being used, there are seven separate glass elements. Some of these are cemented together but there remain in the completed lens six surfaces of glass in contact with air. At each of these surfaces some of the light is reflected, although, of course, most of the light is refracted. At each air-glass interface a reflection represents a loss of light. In addition to the loss, light which suffers a double reflection from two such surfaces re-enters the camera to fall on the film at points other than the appropriate image-forming point for that light. With a lens such as the one used, as much as 4 per cent of the light reaching the film may be such multiple re-

flected light, resulting in a loss of contrast in the developed image. The loss of light is such that the total transmitted may be only some 60 per cent of that which would be transmitted through an ideal lens of the same aperture.

Various attempts have been made to eliminate the reflection at air-glass interfaces. A practical method has been worked out by G. H. Cartwright, of the Massachusetts Institute of Technology, which involves the precipitation of metallic fluorides in a thin film on all the air-glass surfaces. The procedure is carried out on the disassembled lens in vacuum. It is based on an observation of Dennis Taylor, in 1892, that the tarnishing of a camera lens leads to an increase of effective speed. The deposition of fluoride, according to the Cartwright method, is essentially a controlled tarnish of an index of refraction between that of glass and air and of a thickness best suited to reduce reflection. The thickness actually is of the order of one-fourth of the wave length of light.

The lens so treated shows an increase of effective speed and produces a definite increase in photographic contrast.

In 1913, Loman and Camandon used an F 1.55 lens with a specially sensitized film. Luboshez made use of an F 0.625 lens and, still more recently, Dariaux and Djian, a lens of aperture F 0.53. Von Schinzel suggested the use of a screen bent into a surface concave toward the lens so as to correct some of the optical errors of the wide aperture lenses.

In our work a commercial 35-mm. film camera equipped with an F 1.5 lens is used. A slower lens is not suited for this work and there is no faster lens ordinarily available which will cover this field.

The Screen.—In 1897, Pupin suggested that the image obtained by the direct effect of the x-rays might be augmented by the light of a fluorescent screen placed in intimate contact with the film, and thus the intensifying screen came into use. This procedure greatly modified and amplified the application of the x-ray. It made possible roentgenography with rays of a low order of penetration and by shortening the exposure necessary, permitted roentgenography of moving parts; in other words, instantaneous roentgenography. Roentgenography as practised since then, with the intensifying screen, is indirect roentgenography in that the image impressed on the film is, for the most part, an image created by light, the actual direct x-ray effect on the film being negligible in such a set-up. Modern roentgenography is an indirect method of imprinting the image on the recording film. It is not the direct rays which register the image on the film (less than one-tenth of the effect is due to the direct x-rays), but the fluorescent light of the intensifying screen. The actual record made by the direct x-rays, in any practical exposure, is too feeble to leave any useful record.

TABLE I.—AVAILABLE LENSES (F 1.5 OR BETTER) TO COVER 35 MM. DOUBLE FRAME

Name	Manufacturer	F number
Biotar	Carl Zeiss, Jena, Germany	1.4
Cinemat	Ilex Optical Co., Rochester, N. Y.	1.5
Kino-plasmat	Hugo Meyer, Görlitz, Germany	1.5[1]
Lustrar	Wray, Ltd., Bromley, England	1.5[1]
Primoplan	Hugo Meyer, Görlitz, Germany	1.5
Saphir	Les Établiss. Boyer, Paris, France	1.4
Speed Anast.	J. H. Dallmeyer, London, England	1.5[1]
Sonnar[2]	Carl Zeiss, Jena, Germany	1.5
Super-speed Panchro.	Taylor, Taylor & Hobson, Leicester, England	1.3
Xenon[2]	Joseph Schneider & Co., Bad Kreuznach, Germany	1.5

[1] Available data as regards coverage insufficient.
[2] Only the Sonnar and Xenon have been applied to fluorography (35 mm.) at this time.

Actually, the only difference between fluorography and ordinary roentgenography is that in fluorography the image of the fluorescent screen is photographed, while in roentgenography the image of the fluorescent screen is directly transferred to the receiving film.

In general, the screens utilized to-day are those which fluoresce blue and those which glow with a green light. In the former type the material used is an artificially crystallized zinc sulphide compound, while

in the latter complex salts of heavy metals are utilized.

The screen used for fluorography may be of the zinc sulphide (fluorazure type) or a Patterson "B" screen. In this work, both have been used.

The most efficient screen now available, the fluorazure, has a certain amount of lag. During the time of exposure to x-rays the screen emits visible light and after the cessation of the x-ray excitation it continues to do this for an appreciable time at a low degree of brilliance, and is responsible for the so-called "ghost" exposures. The early intensifying screen also had this property, which was later eliminated.

An important question in connection with consideration of this delayed luminosity is whether the luminous energy of such a delayed effect might not be of value in increasing the overall luminous efficiency if, by suitable arrangements, the disturbing effect might be neutralized. A preliminary investigation was, therefore, undertaken for the purpose of analyzing the characteristics of the delayed image in a screen which has a very pronounced lag. The particular screen was, in fact, prepared for the purpose of utilizing the lag image so that it could be used as an x-ray "finder."[1] Of course the results of this investigation are not directly applicable to any commercially available screen nor should they be considered as generalizations. The purpose was merely to become oriented with the problem.

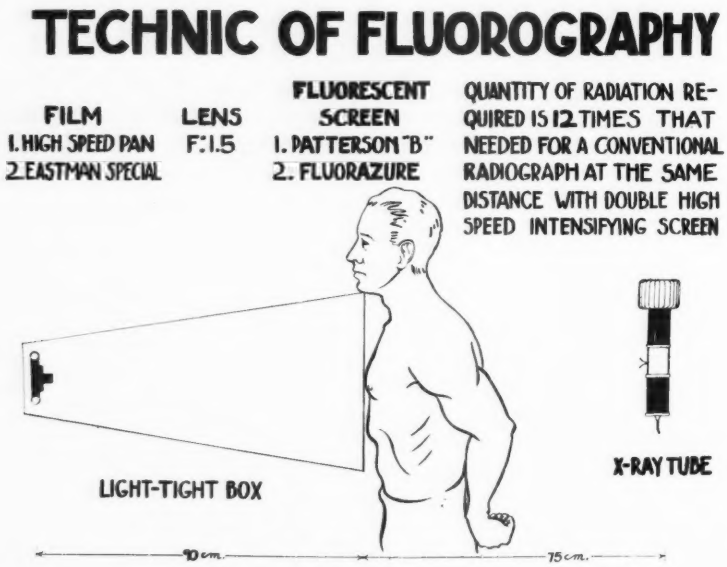

Fig. 2.

The effects which were observed were obtained on Agfa Fluororapid film in the fluorographic camera and developed in x-ray developer.

In order to determine approximately the relative amount of luminous energy emitted after the cessation of excitation, exposures were made directly on the screen with a definite amount of x-radiation (1/15 of a second). A single such exposure was made with 71 kv., and the camera shutter left open for five minutes subsequent to excitation. Several other exposures were then made at varying voltages with the shutter closed immediately after excitation. A five-minute wait was observed be-

[1] Hirsch, I. Seth: A New Type of Fluorescent Screen. RADIOLOGY, **7**, 422–425. November, 1926.

tween these successive exposures. It was found that the same density of film was obtained with 71 kilovolts, with lag, as was obtained with 76 kilovolts without lag. This indicates that roughly 15 per cent of the luminous energy was emitted after the excitation. Practically the whole of the stored energy was released during the first minute.

The gradation and contrast of the delayed luminosity was then studied by making chest exposures with this screen, keeping the camera shutter open for five minutes subsequent to the x-ray exposure. The images so produced showed a very poor contrast, even the heart shadow being darkened. A reduction of the x-ray energy could not improve this condition. The possibility exists that this apparent loss of contrast is due to a spreading of the luminosity over the whole screen during the delayed emission. To exclude this, a sheet of lead was placed over the heart. With this in place the exposure showed no blackening in the covered region. It was concluded, therefore, that the low contrast is due not to a spreading of luminosity but to an inherent low contrast in the delayed emission. The amount of energy emitted in the delayed luminosity is relatively constant and relatively independent of the amount of energy incident upon the screen. That this low contrast is a characteristic of the delayed luminosity alone is evidenced by the fact that a chest film taken on the screen with the shutter closed immediately after the x-ray exposure showed reasonable contrast.

The result of this investigation in its applicability to fluorography may be summed up as follows.

If the screens of higher luminous efficiency can be prepared, we are ready to sacrifice the necessity of instantaneous conversion and permit the existence of appreciable amount of lag or delayed emission. In the lag previously described with such delayed emission, the energy emitted after excitation is not strongly dependent upon the excitation energy. This condition would be a defect in fluorography. If this can be avoided, then the delayed emission type of fluorescent material would be of value. Further studies along this line are in progress.

Fig. 3. Projector for viewing fluorograms.

The photographic film must be suited to the color of the fluorescent light of the particular screen. Both the Eastman and Agfa green-sensitive films give an excellent record of the Patterson "*B*" screen, while the Eastman special fluorographic film is best suited for the "Fluorazure" screen.

The fineness of detail depends on the grain of the fluorescent salt constituting the screen. But brilliancy of illumination depends on large crystalline surfaces and fineness in detail depends on fine crystalline grain. This, then, is the problem. Research along this line is essential if the

ultimate results are to be obtained in fluorography.

Apparatus and Technic.—The apparatus consists essentially of a light-proof box of pyramidal shape with a fluoroscopic screen mounted at one end, a camera at the other, and means for adjusting the height of the apparatus (Fig. 2).

The camera is mounted at a distance of 90 cm. from the screen.

The position of the lens relative to the film has been determined by the use of a grid of microscopic India-ink lines on white paper in place of the fluorescent screen, and an oil-polished green glass in place of the photographic film as a focussing device. However, when a lens of extremely large aperture and a screen emitting colored light are used, the focus for that color is displaced from the main focus for the grid lines. Hence, the true focus for the screen is best obtained by trial exposures.

A positive method of film identification is necessary because the ordinary lead numbers are not always legible. The best method is to record the numbers and letters optically.

The processing of such films requires scrupulous attention to small details. Insignificant dirt particles and scratches may ruin an otherwise good film. All solutions should be filtered and the film should be processed in a suitable tank for the particular size film, different types of which are on the market.

The x-ray exposure required with the material utilized is about twelve times that necessary for the same object with the standard double-coated x-ray film and double high-speed intensifying screens.[2] For the average postero-anterior view of the chest, 88 kv.p., 150 ma., and 1/10 sec. exposure at 80 cm. tube–screen distance is necessary. A full complement for chest examination includes a postero-anterior, anteroposterior, and the two standard oblique views, but for mass surveys a single postero-anterior view suffices. A single fluorographic film exposure subjects the skin to a dose of 0.4 r and the total series to 1.6 r.

[2] In cases in which much work is to be done, allowance must be made for suitable tube-cooling and proper energy distribution. A large rotating anode tube, preferably immersed in circulating oil, is useful. All electrical parts should be designed for heavy duty and the protection throughout should be adequate. The best plant for this work is probably either a condenser discharge apparatus or one with four-valve rectification.

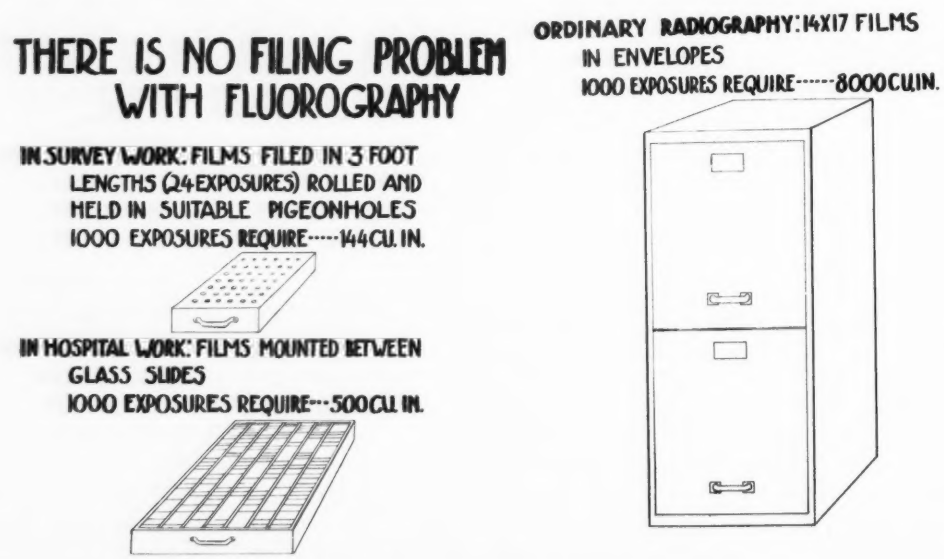

Fig. 4. Comparative methods of filing.

For gastro-intestinal examination, the average case requires 96 kv.p., 80 ma., four seconds at 70 cm. tube–screen distance; for extremities, 90 kv., 80 ma., at 80 cm., and for skulls, 90 kv., 160 ma., at 60 cm.

The thin Swedish grid diaphragm should be used for all exposures except those of the chest. In this grid, the opaque elements are so fine and so close together that on the small films the grid lines are not obvious to the naked eye.

The films are most conveniently viewed by projection. It is desirable to keep the magnification down to a relatively low value so that the eye may take in the picture at one glance (Fig. 2). By projecting the film to a magnification of 6.8 times, an image is obtained which is 15 per cent smaller than half size of the original screen image. For the average chest, this just compensates for the distortion due to the use of 80 cm. target–screen distance. Thus the projected image, under these conditions, is a true half-size representation of the chest in the average case. A good projector is necessary, as is a grainless viewing screen of a pale green color. The time required for the examination of the fluorograms is influenced by the number of abnormal films. If these are few, 250 mounted films may be examined in an hour. As many as 350 have been examined when the records are on continuous strips. In tuberculosis surveys, the findings may be checked off on a prepared card (Fig. 5). A comparison between reductions from 14 × 17 in. films and enlargements from fluorographs to the same size, on bromide paper, shows no loss of important detail from the enlargements.

Advantage of the Method.—The paramount advantage of fluorography lies in the simplicity of the method and in the reduction in the cost of the examination, particularly in thoracic and gastro-intestinal work. The saving may be considered under four headings: (1) film; (2) developer; (3) filing space, and (4) intensifying screen and cassettes.

Film: The section of 35-mm. film used for a chest examination costs but 2 per cent of the price of the 14 × 17 in. regular film.

Developer: The 12 ounces of developer used in the small developing tank will develop two lengths of 150-cm. film, in other words, 72 chest exposures, and one gallon of developer will develop about 720 fluorographic chest exposures, while less than 50 films, 14 × 17 in., can be properly developed in this quantity of solution.

Filing Space (see Figure 4): One thousand chest fluorographs can be filed in a wooden drawer at a negligible cost. This number of large films would require a two-drawer cabinet of the usual size.

Intensifying Screen: The intensifying screens mounted in cassettes entail the additional procedure of loading and unloading. In the average laboratory, tons of metal are transported yearly to and from the dark room. Each cassette is handled nine times in the making of each roentgeno-

COST

Estimate per 1,000 examinations in hospital work, neglecting marginal cost of rent, labor, over-head, and medical service

Apparatus and Depreciation	$ 30.00
Films, Chemicals, etc.	
Fluorographs	$ 46.00
Roentgenographs—Paper (14 × 17 in.)	374.00
Roentgenographs—Film (14 × 17 in.)	574.00
Total Cost per 1,000	
Fluorographs (Films 1 × 1 in.)	$ 76.00
Roentgenographs (Paper 14 × 17 in.)	404.00
Roentgenographs (Films 14 × 17 in.)	604.00

Routine fluorography of every admission in a 100-bed hospital would cost less than $1.00 per day.

Name..... Date..... No.....
No abnormal findings.....
Suspicious.....

		Upper	Middle	Lower	
Infiltration	Exudative				Non-tbc. lesion
	Productive				
	Mixed				
	Cavitation				Heart
Fibrosis	Parenchyma				
	Pleura				
Calcification	Parenchyma				Aorta
	Pleura				
	Nodes				

Fig. 5. Check system for preliminary analysis of chest fluorograms in surveys for tuberculosis.

gram. In a laboratory in which 10,000 chest films 14 × 17 in. in size, are made each year, 88,400 pounds, or over 44 tons, of metal are transported yearly. The purchase and maintenance of cassettes and intensifying screens is a considerable yearly item in a large laboratory.

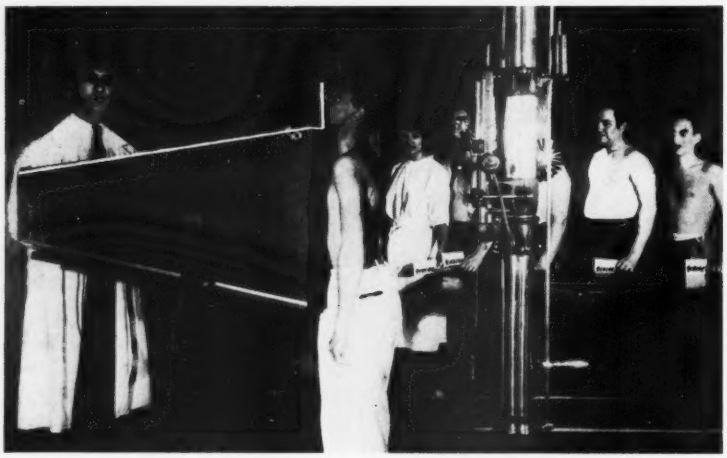

Fig. 6. Each subject carries in his hand a card which bears on one side the clinical data and on the other a number. This card is inserted in a slot below the screen against which the subject places his chest. The chin is inserted in a notch at the top of the screen. It is most important that the chest be symmetrically placed and that the apices be fully exposed. The exposure is made in deepest inspiration. After the x-ray exposure has been made, the number on the card is photographed on the same film optically.

Application.—The method is, at this stage, applicable to the study of organs in which the contrast of tissue is naturally marked or may be made so artificially by the use of contrast substance. Thus, the lungs, pleura, heart and aorta, in particular, lend themselves to fluorography, as does the bony system, skull, urinary tract, gastro-intestinal tract, and esophagus when contrast media are used.

Because of its small cost, the fluorographic examination renders particularly valuable service for interval examinations in cases of tuberculosis, pericardial and pleural effusions, and in cases of tumors of the lung and mediastinum in which prolonged observation becomes necessary and an x-ray control is essential. So, also, the method is applicable for the serial study of heart form and size and for the determination of the variations in the size and shape of the heart, vascular pedicle, and hilar shadows following such procedures as the Valsalva and Müller tests and for the determination of the position of the diaphragm after phrenicotomy and of the mediastinum and lung following pneumothorax. It provides a cheap and efficient method of serial examinations of the gastro-intestinal tract, particularly for the study of motility.

The low cost of fluorography makes possible the examination of large groups and permits surveys of whole populations, an application of tremendous social value. It makes possible the routine examination of the chest and gastro-intestinal tracts of all patients admitted to the hospital, a routine which will undoubtedly soon be introduced and will aid in the early diagnosis of many diseases of the lungs, heart, mediastinum, and gastro-intestinal tract. In hospitals where from 30 to 40 per cent of admissions have an x-ray examination of the chest, not over 10 per cent of the films

show positive changes of value to the clinician. These pathologic cases are, therefore, discovered at an enormous cost

cient clarity to permit an accurate differential diagnosis of disease of various viscera.

The reading of the fluorographs requires

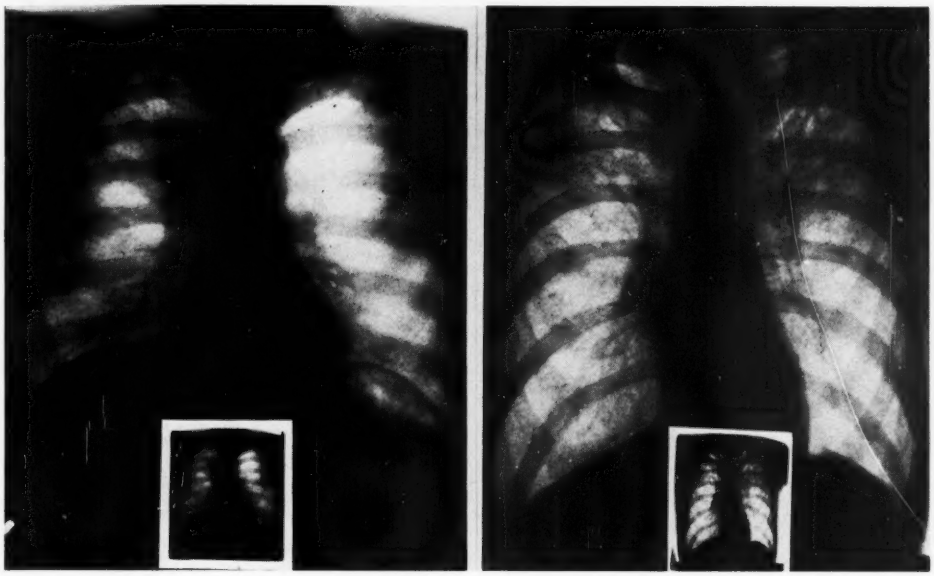

Fig. 7. Fluorograms of the chest, actual size and enlargements.

which fluorography—even when applied to 100 per cent of admissions—will reduce materially.

Fluorography of the bony system makes possible mass anatomic-anthropologic surveys as, for instance, in the study of ossification of the wrist bones, in the study of head forms, and in the study of general habitus and its relationship to visceral morphology.

Evaluation.—In spite of the advantages cited, the main criterion by which this method is to be judged is its value as a diagnostic record. It is, of course, conceded that the fluorogram—whether the 35 × 35 or the 100 × 125 mm.—has not yet attained the clarity of contrast and sharpness of detail which characterizes the large film nor has it as yet the general applicability of the large film. If the fluorogram permits the determination as to whether or not a pathologic deviation exists, then it fulfills its purpose. It does this and, under certain conditions, depicts details with sufficient clarity to permit an accurate differential diagnosis of disease of various viscera.

The reading of the fluorographs requires an experience based on reading ordinary films. Educated by such an experience, the trained eye readily picks out the deviations from the normal with no greater difficulty than in the large film. Particularly in chest examinations does it show with clarity, though in miniature, all the criteria on the basis of which pulmonary and cardiovascular lesions are diagnosed. The fluorographic record has the defect of its virtue in that the crowding of detail results in a loss which cannot be overcome by magnification. The smallness of the film holds no terror for the roentgenologist. It means to him only a simple adjustment of his technic. Nor does the small film increase the difficulties of diagnosis nor hide any secrets from his trained eye, though it does come as a shock to those whose experience in roentgen diagnosis has been confined to a single and limited field and who have never mastered the basic principles of roentgen diagnosis. But its great virtue as a simple, cheap, and

efficient "diagnostic filter" gives it an inestimable value as a clinical method.

In recent years attempts have been made to examine for tuberculosis on a larger scale than ever before, and every year millions of tuberculin tests are administered to isolate reactors. The analysis is, however, incomplete without an x-ray examination. It is this inability to examine large masses of individuals showing no clinical or laboratory evidence of disease which is responsible for the failure to diagnose tuberculosis in its minimal stage in but a small fraction of the population.

Fluoroscopy has been used extensively for tuberculosis surveys and, while inexpensive, is relatively inaccurate, gives no permanent record, and is impractical in its application to the study of large groups because of the imposed limitation of 250 examinations per day by a single individual. On the other hand, 350 fluorograms can be read per hour.

Surveys have been made with special apparatus which use paper films on rolls, but even this method is expensive and cumbersome and does not lend itself to general application and to the survey of large communities, though it is conceded that even this method is superior to fluoroscopy.

However, fluorographic surveys on 35-mm. films fill every diagnostic requirement, permitting the determination of the earliest lesions both in the lungs and the lymph nodes. The routine and methods of its application are simple, rapid, and practical, and the cost is small. The tempo and cost are important considerations in mass surveys.

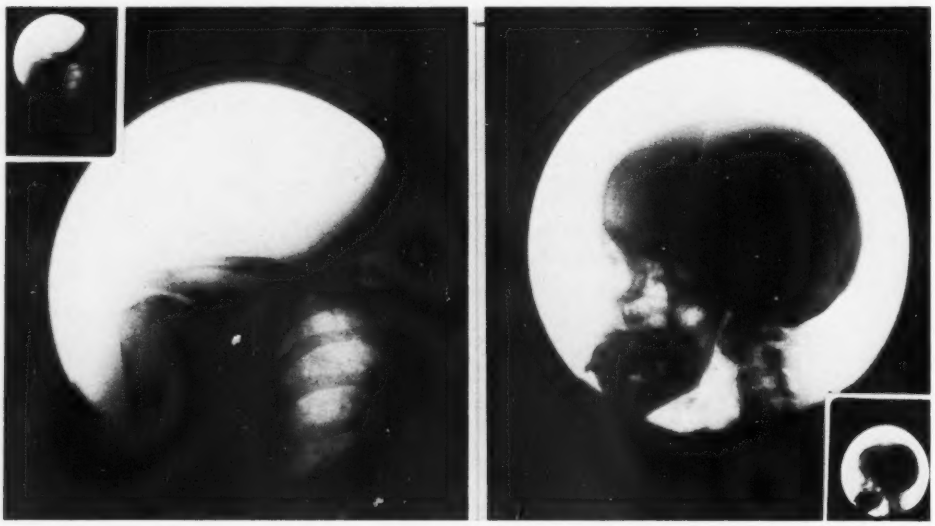

Fig. 8. Fluorograms of bones, actual size and enlargements.

If one studies the history of x-ray diagnosis from its crude and limited application in the years immediately after the discovery to its present wide and manifold uses, it is obvious that its development has been one of the most remarkable achievements even in a period characterized by revolutionary scientific changes.

The introductory stages of roentgenology consisted of a period of hectic experimentation during which practically every method and technic now utilized was foreshadowed more or less crudely. Then followed a period of refinement, development, and extension of this diagnostic method into every branch of medicine and surgery.

The wide application soon disclosed the fact that extensive pathologic changes

may exist in the body without any clinical manifestations. This holds not only for congenital anomalies, but for actual disease of tissues.

In the lung, extensive infiltration by tuberculosis and carcinoma are continually disclosed in accidental examinations and there is not a viscus in which unsuspected lesions, not only in the incipient but in the well advanced stage, have not been discovered. It has, therefore, been made clearly evident that the body may harbor pathologic changes which do not by subjective and objective clinical evidence give any clue to their presence, and which are disclosed only by the x-ray examination.

This leads to the thought that a wider extension of the beneficent service would be eminently desirable, but the cost of the x-ray examination prevents the general extension of this service to whole populations. But for this there would then be no reason why x-ray surveys could not be made as universal as vaccination. At certain periods of life, an x-ray survey might be made of the bony system; at another, of the thorax, and at another, of the abdominal viscera. The wealth of medical and anthropologic information which would be thus disclosed is inestimable.

With the introduction of fluorography, which simplifies and materially reduces the cost of the examination, it becomes possible to think of the x-ray examination in universal terms.

Thus the roentgenologist takes his place in the great social movement for human betterment, and thus roentgenology enters its third and most important phase, as one of the great forces of preventative medicine.

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IRRADIATION TREATMENT OF CANCER OF THE SKIN[1]

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IT is the purpose of this paper to discuss some of the different types of skin cancer and to outline acceptable modes of treatment which may be used in each type. It is recognized that more than one method or combination of methods may be successfully used in many lesions. No statistical study of a group of cases will be presented.

So many articles dealing with the microscopic classification of skin cancer have been published in the last decade that a detailed presentation of this phase of the subject will not be attempted. The vast majority of malignant skin lesions are either basal-, squamous-, or mixed-cell epithelioma. Adenocarcinomas, arising from sweat or sebaceous glands, constitute less than 1 per cent of skin cancers, and other malignant skin lesions are still rarer. It is not within the scope of this paper to discuss the differential diagnosis of skin lesions. It is true that many non-malignant skin lesions may be mistaken for skin cancer. An accurate diagnosis is essential, and, in case of doubt, a biopsy is indispensable.

Biopsy.—In the past, there has been some difference of opinion in regard to biopsy. Most men who treat cancer now agree that there is no danger of dissemination of the disease by a properly taken biopsy. A considerable amount of information can be obtained from a study of the tissue removed. A warning should be sounded regarding an improperly taken biopsy. If a local anesthetic is used and the area of cancerous invasion is infiltrated, or if undue roughness is used in handling the tissues, the chance of producing a metastasis certainly exists. When the biopsy is properly taken, these dangers are not present.

While biopsies are taken almost routinely, and they add much to the case records, they exert little influence in determining the type of irradiation or the total dose to be used. Cases which appear clinically to be basal-cell carcinoma are sometimes proven microscopically to contain squamous cells. Williams (29) states that in his series, 10 per cent of the basal-cell carcinomas were in this group. All of us have had the experience of having a case, which was diagnosed basal-cell carcinoma, both clinically and microscopically, develop a metastasis and have the metastasis show squamous cells. Most radiation therapists administer what they consider an adequate dose of irradiation without regard for the microscopic type of the lesion. Some basal-cell carcinomas may be overdosed by such a procedure, but no harm is done and fewer recurrences and failures occur.

Precancerous Lesions.—While some areas of leukoplakia and keratosis may require irradiation, most of them are more efficiently treated by electrocoagulation with surgical diathermy. Some men prefer surgical removal of areas of keratosis on the lip. This does permit microscopic study of the removed tissue, even in the case of extremely small lesions. In this location, we prefer to treat with heavily filtered roentgen rays or radium and to administer a dose large enough to destroy the lesion completely even if cancerous changes are taking place; that is, 5 or more S.E.D. Such a procedure is not advocated in the very early keratoses of the lip, but in those cases in which there may be some question of early malignant change. Such a plan of treatment leaves no scar, or, at most, a very soft scar, with perfect cosmetic results.

As the educational campaign in regard to cancer progresses, all physicians, particularly radiologists and surgeons, are see-

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ing more early cancer and more precancer cases. This is certainly true of cancer of the skin. Many cases with keratoses will require repeated treatment because some of the older ones will develop a new group of lesions every few months. This is a good reason why such a simple procedure as electrocoagulation should be used in preference to irradiation. When an early cancer is suspected in any given area of keratosis, adequate irradiation should be used.

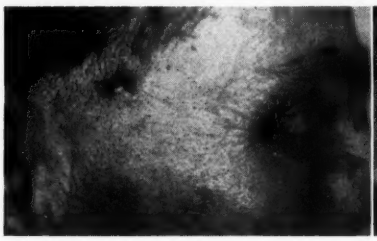

Fig. 1.

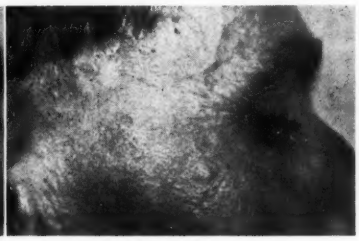

Fig. 2.

Fig. 1. J. W. K., white male, aged 50 years, March 6, 1939. Basal-cell carcinoma which had recurred following incomplete removal by coagulation.
Fig. 2. J. W. K., May 8, 1939. Healed. Appearance two months after administration of 3,000 r in 1,000 r doses given every other day (85 kv., 0.5 mm. Al filter).

Methods of Treatment.—It is true that skin cancer can be adequately treated by surgery, and there are certain types of skin cancer, or skin cancer in certain locations, which may require a combination of surgery and irradiation. It is also true that during the last decade the improvement of methods of treatment by irradiation and particularly the more general application of the knowledge which was previously known have greatly increased the number of skin cancers being treated successfully by irradiation. An example of this is the published results of Martin (19, 20) who, for many years, has been curing a high percentage of all types of skin cancer by irradiation. Grier (7, 8, 9), Widmann (27, 28), and others have reported equally good results. In spite of these known results, most textbooks on surgery and skin diseases have continued to state that irradiation was not effective in squamous-cell carcinoma and to advocate surgery. Most failures to cure skin cancer with irradiation have been due to inadequate dosage. Often, the total dose given was large enough if it had been given within a short time, but when spread out over several months' time, was not effective. The published results of the successful treatment of squamous-cell carcinoma of the skin during the last decade are too many to enumerate.

Many competent physicians continue to advocate surgery in cases in which cancer has involved cartilage. A case will be reported which illustrates the fact that with adequate dosage many of these cases can be cured with irradiation. It is true that each physician should use the methods with which he is most familiar. It is equally true that good surgery is better than poorly managed irradiation, and that good irradiation is to be preferred to poor surgery. If any progress is to be made in the control of cancer, whether it be cancer of the skin or of some other part of the body, the knowledge as how best to treat that particular lesion must be in the hands of many men and not just a few. It is encouraging that more and more radiologists are adequately treating skin cancer with correspondingly better results. Until the last few years, this was not true, which probably to some extent accounts for the fact that many of these lesions were handled surgically, or were neglected and received no adequate treatment of any kind. It is needless to say that only irradiation and surgery

should be considered in selecting the method of treating skin cancer.

It should be emphasized that each case of skin cancer must be individualized in selecting the particular type of irradiation to be used, and that the procedure may have to be varied as the case is followed. Not only must the type, location, and extent of the lesion be considered, but the ability or willingness of the patient to cooperate must be taken into account. If the patient has a lesion which can be adequately handled by low or moderate voltage x-rays administered in a few treatments covering a short period of time, it would be unjustifiable to treat the case with high voltage and heavy filtration, which would require a much longer period of time. Such considerations are particularly important in private patients, many of whom come from great distances, and whose economic status does not permit much travel, or long periods away from home. In cases in which better results can be obtained by more prolonged irradiation, such considerations should not influence the selection.

Radiologists are indebted to Widmann (27, 28), Grier (7, 8, 9), Martin (19, 20), and others for developing and popularizing the use of massive doses of low or medium voltage x-ray with little or no filtration. Practically all small lesions, such as Cases 1 and 2, are routinely handled by such irradiation. In fact, much larger lesions can and are successfully treated by this plan. We prefer to treat the large indurated lesion, with or without associated infection, and all lesions involving cartilage, with x-rays generated at high voltage, with heavy filtration, or with a combination of high and low voltage. Carcinoma of the lip is usually treated with x-rays generated at high voltage with heavy filtration or with radium. Radium may be used in place of high voltage x-ray, and the selection is usually dependent on the personal choice of the radiologist. In selected cases, we prefer to supplement the x-ray treatment with interstitial low intensity radium element needles. In all cases requiring radium needles, scopolamine and morphine have produced a satisfactory analgesia.

Whatever form of irradiation is used, it is essential that a fairly wide margin of adjacent skin be included in the field of irradiation, 0.5 in., if possible.

Dosage.—In the comparatively small lesions, either basal- or squamous-cell carcinoma, the technic described by Widmann is followed in all essential details, except that in all but the extremely small lesions, a larger total dose is used. In the lesions elevated less than 0.5 cm. above the skin, from 4,500 to 5,000 r are given and divided into three doses which are administered every other day. The voltage and filtration varies from 85 kv. with 0.5 mm. Al filter to 125 kv. with 1 mm. Al filter, depending on the equipment available. The effective wave length, when 85 kv. with 0.5 mm. Al filter is used, is 0.5 Å. and when 125 kv. with 1 mm. Al filter is used, it is 0.45 Å. Lesions elevated 0.5 cm. or more above the skin receive the same general treatment except that 6,000 r are given and divided into four doses, which are given every other day. Our experience has been that this dosage produces a larger percentage of cures with no unfavorable sequela.

In all lesions involving cartilage, in all lesions of the lip, and in the so-called "radioresistant" types of squamous-cell carcinoma, irrespective of size and location, shorter wave irradiation is preferred. X-rays generated at 200 kv. with 1 or 2 mm. of Cu plus 1 mm. Al, or x-rays generated at 220 kv. with a Thoraeus filter equivalent to 3 3/4 or 5 mm. Cu, are used. The effective wave length when 200 kv. with 2 mm. Cu and 1 mm. Al is used is 0.112 Å. When 220 kv. with the equivalent of 3 3/4 mm. Cu is used, the effective wave length is 0.085 Å., and when 220 kv. with the equivalent of 5 mm. Cu is used, it is 0.08 Å. Radium applied in the form of small packs with a filtration of 1 mm. of platinum may be used instead of the heavily filtered x-rays, with equally good results. The total dosage must approxi-

mate that obtained by the heavily filtered x-rays, that is, from 5 to 10 S.E.D. In selected cases, radium needles containing has been found in cases treated with these two technics. While it is not always possible to use the heavier filtration on ac-

Fig. 3. Fig. 4. Fig. 5.

Fig. 3. M. D., white female, aged 73, March 20, 1939. Squamous-cell carcinoma which had recurred following treatment with a paste. Duration of recurrence three months.
Fig. 4. M. D., May 5, 1939. Appearance six weeks after administration of 3,500 r (85 kv., 0.5 mm. Al). The cancer had regressed, but was not controlled. Additional dose of 4,000 r was given at this time.
Fig. 5. M. D., Oct. 10, 1939. The lesion had been completely healed since July 1, 1939. There was a soft scar which was slightly depressed.

from 0.6 to 1. mg. of radium element per active cm. length and with a filtration of 0.6 mm. of platinum are used and left in place for one week, during which time the dose is supplemented by from 1,800 to 2,100 r of x-ray, at 200 kv. with 2 mm. Cu plus 1 mm. Al filtration, given in 300 r daily doses. This technic is essentially that described by Martin (14) for the treatment of metastatic cervical glands. I am convinced that this technic is both efficacious and safe.

When x-rays alone are to be used, in cases of cartilage involvement or in the resistant types of squamous-cell carcinoma, 300 r are given daily until 4,500 r have been administered. This plan of treatment is followed when 200 kv. with 1 or 2 mm. Cu plus 1 mm. Al filtration is used, or when 220 kv. with a combination filter equivalent to 3 3/4 or 5 mm. Cu is used. No difference in the end-results obtained count of the time required to administer the dose, it is certainly true that less caustic reactions are produced and, in many cases, better cosmetic results seem to be obtained. The rate at which the x-ray is administered is important, and the rate of administration certainly affects the total dose to be given, as has been pointed out by Martin (13) and others.

Irrespective of the plan of treatment selected, all cases should be followed and required to report for examination at one- or two-week intervals for several months and at less frequent intervals for a much longer period of time. Any cancerous residue or recurrence is given additional irradiation. Frequently, in lesions originally treated with heavily filtered x-rays generated at high voltage, the supplementary irradiation of from 1,000 to 3,000 r is generated at low or moderate voltage with a small amount of filtration.

CASE REPORTS

Case 1. J. W. K., white male, aged 50 years, was first seen on March 6, 1939. There was a basal-cell carcinoma on the right temple area, 3/4 in. in diameter, which had been present for three months. The lesion had been incompletely removed six weeks before by coagulation and had promptly recurred. Figure 1 shows the appearance of the lesion at this time. This type of skin cancer can be cured by several procedures, if they are properly carried out. The entire area could be excised or could be destroyed by electrocoagulation. The simplest way in which to handle such a case, the one which will give the patient the least amount of discomfort with the best cosmetic result, is to destroy the cancerous area with x-rays or radium. Between March 6 and 10, 1939, 3,000 r generated at 85 kv. with 0.5 mm. Al filter were given in doses of 1,000 r every other day.

Following a moderately severe reaction, the lesion healed quickly. Figure 2 shows the condition of the area on May 8, 1939.

This case is presented to illustrate a simple basal-cell carcinoma which may be handled successfully in a variety of ways. An adequate dose of irradiation, either x-rays or radium, may be expected to cure such a lesion quickly with good cosmetic results.

Case 2. M. D., white female, aged 73 years, was first seen on March 20, 1939. She had a squamous-cell carcinoma on the nose, 1.5 in. from the tip, which measured 0.5 in. in diameter. The diagnosis was confirmed by biopsy. The patient stated that she had had a similar lesion in the same location three years before, which had been cured by the application of a paste. The present lesion had been on the nose for three months, and had grown rapidly during the preceding four weeks. The present carcinoma seemed to have originated around the edge of a small depressed scar. The edges of the present tumor were elevated and hard. Figure 3 shows the appearance of the nose on March 20, 1939. A total of 3,500 r of x-ray was given at 85 kv. with 0.5 mm. Al between March 20 and 23, 1939, being divided into four doses. A fairly vigorous reaction resulted, followed by some regression of the cancer. The appearance of the nose on May 5, 1939, is shown in Figure 4. It was apparent at this time that a cure was not going to be obtained unless additional irradiation was given. A total of 4,000 r at 85 kv. with 0.5 mm. Al was given between May 5 and 9, 1939, in 1,000 r daily doses. Complete disappearance of the cancer, with healing of the area, occurred, following the usual reaction. This healing was complete by July 1, 1939. Figure 5 shows the condition of the nose on Oct. 10, 1939. The scar is soft and white.

This case is reported to show that a small squamous-cell carcinoma may be adequately irradiated by x-rays generated at low voltage with little filtration, even when located adjacent to cartilage. There was no indication that the cartilage was involved in this case. Quicker results would have been obtained if the initial course of treatment had consisted of from 5,000 to 6,000 r instead of 3,500 r.

Case 3. R. C. H., white female, aged 54 years, was first seen on Oct. 4, 1938. There was a hard elevated lesion, measuring 1.5 in. in diameter, which covered a considerable portion of the nose. The growth was elevated 3/16 in. above the skin level. The central part of the tumor area was ulcerated. The induration extended well into the cartilage, but no ulceration could be demonstrated on the inside of the nose. Biopsy showed mixed-cell carcinoma. The patient stated that there had been a small skin tumor on the nose for three years, which had begun to grow three months before. Figure 6 shows the appearance of the nose at that time.

Between Oct. 4 and 21, 1938, 4,500 r of x-rays were given at 220 kv., with a combination Thoraeus filter equivalent to 5 mm. Cu, in 300 r daily doses; 0.5 in. of skin around the cancerous area was included. Following vigorous reaction, marked improvement of the lesion occurred (Fig. 7). The edges were still hard and elevated. Between Nov. 29 and Dec. 1,

1938, 3,000 r additional were given at 85 kv. with 0.5 mm. Al filter, in 1,000 r daily doses. Healing proceeded without interruption following this second course of treatment and was complete by Feb. 1, 1939. Figure 8 shows the appearance of the nose on May 10, 1939. The scar is soft, white, and only slightly depressed. The area has remained healed.

This case is presented as an illustration of mixed-cell carcinoma, with invasion of cartilage, which appears to have been cured by x-rays with very good cosmetic results. Unless this case had been kept under close observation and the additional course of irradiation given before the residue of the tumor had recovered from the first course of treatment, a cure might not have been effected.

Case 4. F. W., white male, aged 79 years, was first seen on Sept. 6, 1938. There was a carcinoma on the left cheek just below the outer canthus of the eye, 1 3/4 in. in diameter. The lesion had been present for only three months, and during the preceding four weeks had more than doubled in size. The edges were elevated and hard and the center was ulcerated. A biopsy showed mixed-cell carcinoma. Between Sept. 6 and 20, 1938, 3,600 r were administered in daily doses that varied between 200 and 300 r. These x-rays were generated at 200 kv. with a filtration of 1 mm. Cu plus 1 mm. Al.

The lesion continued to spread and little or no regression was noted as a result of the x-ray therapy. Figure 9 shows the condition of the lesion on Oct. 12, 1938. On this date, interstitial radium needles were introduced. Six needles, each containing 1 mg. of radium, with an active length of 12 mm. and a filtration of 0.6 mm. platinum, and six needles, each containing 0.6 mg. of radium, with an active length of 10 mm. and a filtration of 0.6 mm. platinum, were used. Figure 10 shows the needles in place. A better arrangement of the needles in the base of the lesion would be a parallel arrangement, as has been pointed out by Martin (14). Black silk was used to retain the needles in position. The needles remained in place for one week.

Fig 6. Fig. 7. Fig. 8.

Fig. 6. R. C. H., white female, aged 54 years, Oct. 4, 1938. Carcinoma of nose shown by biopsy to contain squamous cells. Duration three years.

Fig. 7. R. C. H., Nov. 29, 1938. Appearance five weeks after the administration of 4,500 r (220 kv., Thoraeus filter equivalent to 5 mm. Cu). At this time an additional 3,000 r were given (85 kv., 0.5 mm. Al).

Fig. 8. R. C. H., May 10, 1939. The area was completely healed and has remained so.

Following the usual vigorous radium reaction, the lesion began to heal. Before healing was complete, an extension occurred beneath the eye. On Dec. 15, 1938, this new area of cancer was treated with interstitial needles similar to those described above, and the needles were left in position for one week.

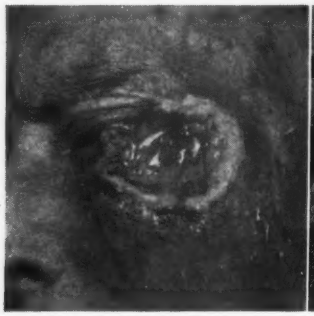

Fig. 9.

Fig. 10.

Fig. 9. F. W., white male, aged 79 years, Oct. 12, 1938. Duration four months. Appearance of the lesion three weeks after the administration of 3,600 r (200 kv., 1 mm. Cu plus 1 mm. Al).

Fig. 10. F. W., Oct. 14, 1938. Interstitial radium element needles in place. (See text for dosage.) A parallel arrangement of the needles placed in the base of the lesion would have been better.

Fig. 11.

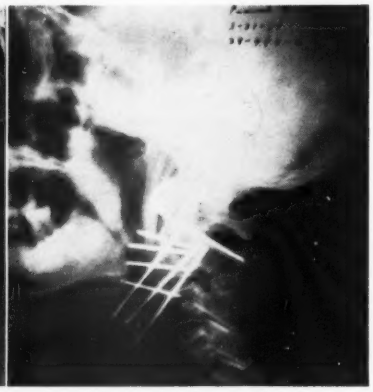

Fig. 12.

Fig. 11. F. W., March 18, 1939. Interstitial radium element needles in place for treating a metastatic gland. X-rays were given while needles were in place. (See text for dosage.)

Fig. 12. F. W., March 18, 1939. Roentgenograph showing arrangement of interstitial radium element needles.

Still another extension and recurrence took place about Feb. 1, 1939. At this time, in addition to an extension beneath the eye nearer the nose, in tissue that had not previously shown malignant changes, there was a small recurrence at the site of the original lesion. On Feb. 10, 1939, interstitial radium needles of the type described above, were again used.

Before the reaction from the last group of needles used in the face had subsided, a metastatic gland appeared at the angle

of the jaw. This metastatic gland was treated by the method described by Martin (14). Radium needles were introduced through and under the gland on March 18, 1939, and remained in place five days. Four needles, each containing four 1 mg. cells, active length 4 cm., and four needles, each containing two 1 mg. cells, active length 2 cm., with a total filtration of 0.6 mm. platinum, were used. During the time the needles were in place, 2,500 r were administered at 140 kv. and the equivalent of 6 mm. Al filter in five doses of 500 r each. This dose was given over a 10 × 10 port. Figure 11 shows the needles in position and Figure 12 is a roentgenograph of the needles in position. Perhaps 200 kv. would have been better because a less caustic skin reaction would have been produced. The equipment available in the hospital at the time influenced the selection of moderate voltage.

One other metastatic gland appeared early in August, 1939, and was well below the first gland and outside the area treated at that time. It was located in the lower part of the left cervical region just above the clavicle. It was treated with interstitial radium needles and superimposed x-rays between Aug. 8 and 13, 1939, with complete regression of the gland. The same dose of radium and x-rays was used as in the previous metastatic gland. At the present time, the case appears to be free of demonstrable cancer.

This case is presented as an illustration of an unusually rapidly advancing cancer of a radioresistant type, which has been controlled by irradiation. In such cases, palliation is a desirable objective; permanent cure is hardly to be expected. Unless the case had been kept under close observation and repeated large doses of radium and x-ray administered, the rapidly advancing cancer would undoubtedly have destroyed a considerable portion of the left side of the face in a short time. The repeated large doses of radium and x-ray used in this case are not advocated and are not necessary in the average case.

Case 5. J. S., white male, aged 76 years, was first seen on Jan. 18, 1939. There was a basal-cell carcinoma involving a large area on the right cheek. The base of the cancer measured 2.5 in. in diameter, and the upper edge of the growth had extended to within 0.5 in. of the outer canthus of the eye. The growth was elevated 1.5 in. above the skin level. Figure 13 shows the appearance of the cancer at that time.

This type lesion could have been successfully treated by several methods. We elected to use a combination of interstitial radium needles in the base of the growth and x-rays applied at the same time the needles were in place.

On Jan. 20, 1939, four 1 mg. needles and eight 0.6 mg. needles, with a filtration of 0.6 mg. platinum, were inserted in the base of the lesion, a spoke-like arrangement

Fig. 13. Fig. 14 Fig. 15

Fig. 13. J. S., white male, aged 76 years, Jan. 18, 1939. Large basal-cell carcinoma. Duration one year. Radium element needles placed in the base of lesion and 2,000 r given. An additional 2,500 r were given between March 6 and March 10, 1939.
Fig. 14. J. S., May 10, 1939. The lesion is almost healed.
Fig. 15. J. S., Aug. 29, 1939. Healing has been complete since early in June.

being used. Subsequent experience shows that a parallel arrangement would have been better. During the week the needles were in place, 2,000 r were given at 140 kv. with 6 mm. Al filter in 500 r doses. These were administered every other day.

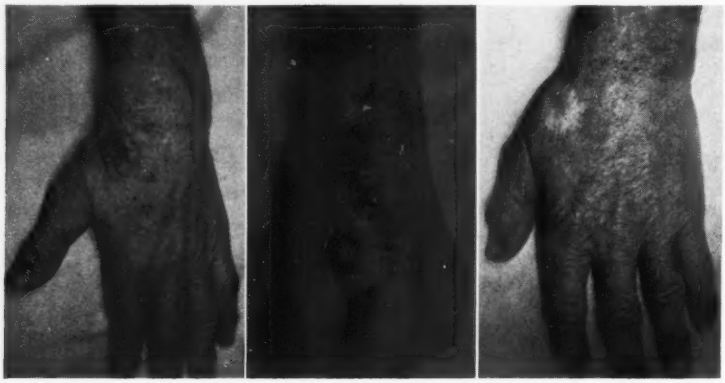

Fig. 16. Fig. 17. Fig. 18.

Fig. 16. J. C. P., white male, aged 77 years, Jan. 25, 1939. Squamous-cell carcinoma. Duration one year. A total of 6,100 r was given between Jan. 25 and Feb. 11, 1939 (200 kv., 1 mm. Cu, plus 1 mm. Al).

Fig. 17. J. C. P., March 3, 1939. Cancer persists. Between March 3 and March 6, 1939, 3,000 r were given (85 kv., 0.5 mm. Al) and between April 14 and April 16, 1939, another 3,000 r were given (85 kv., 0.5 mm. Al).

Fig. 18. J. C. P., Oct. 2, 1939. The lesion has been completely healed since June 1, 1939. There is a soft scar. No fixation present.

The lesion regressed rapidly, following vigorous reaction, and by Feb. 15, 1939, was 1.5 in. in diameter and elevated 3/4 in. above the skin. No further regression occurred during the following three weeks and early in March 2,500 r additional were given at 140 kv. with 6 mm. Al filter in doses of 500 r every other day. Improvement was rapid after this time, and by May 10, 1939, the lesion was almost healed (Fig. 14). Complete healing occurred and has been maintained. There is a soft scar. The lower eyelid is not retracted and vision has not been impaired. Like most cases of skin cancer in old persons, areas of keratosis have appeared on other parts of the skin of the face and hands. Figure 15, taken on Aug. 29, 1939, shows such an area at edge of the scar. These areas have been coagulated as they have appeared and have responded satisfactorily.

Case 6. J. C. P., white male, aged 77 years, was first seen on Jan. 25, 1939. There was a squamous-cell carcinoma on the back of the left hand near the base of the thumb, which measured 1 in. in diameter. This lesion had been present for one year and had gradually increased in size during that time. The edges were elevated and hard, and the center was beginning to ulcerate. The growth was firmly attached to the underlying structures, and, while not fixed, was not freely movable. There was no evidence of axillary metastases and roentgenographs of the chest were negative. The patient also had numerous areas of keratosis on the face. Figure 16 shows the condition of the lesion when the patient was first seen. Beginning on Jan. 25, 1939, x-rays were administered to the epithelioma and 3/4 in. of adjacent skin in 300 r daily doses until seven doses had been given. Immediately following this, beginning Feb. 2, 1939, 500 r were given daily for eight treatments; thus, a total of 6,100 r was given in a period of 17 days. All of these x-rays were generated at 200 kv. with a filtration of 1 mm. Cu plus 1 mm. Al. Dur-

ing this same period of time, 1,600 r were delivered to the axilla and to the elbow region on the left side, in 200 r daily doses. These x-rays were also generated at 200 kv. with 1 mm. Cu plus 1 mm. Al filter.

The lesion regressed following the reaction, but Figure 17, made on March 3, 1939, shows that the lesion was not healing, and that the cancer persisted. Between March 3 and 6, 1939, 3,000 r were given at 85 kv., with 0.5 mm. Al filter, in 1,000 r daily doses. Further regression occurred, but definite malignant cells persisted, as shown by a biopsy made on April 12, 1939. Between April 14 and 16, 1939, 3,000 r additional were given in 1,000 r daily doses at 85 kv. with 0.5 mm. Al filter. This made a total of 12,100 r given to this area in less than three months' time. After the reaction subsided, the lesion healed and healing was complete by June 1. The scar is soft and no fixation to the underlying deep structures exists. The lesion has remained healed, and no metastases have occurred. Figure 18 shows the condition of the hand on Oct. 2, 1939.

This case is presented as an example of a highly resistant type of squamous-cell carcinoma which did not respond to the usual dose of x-ray. Unless the case had been followed over a long period of time, and two additional courses of irradiation had been given, the disease process would not have been controlled. It illustrates also that when small areas of tissue are involved, extremely large doses of x-ray can be used with perfect safety. Again, it should be emphasized that the average case does not require such a large dose.

CONCLUSIONS

1. While biopsies are taken almost routinely and furnish much valuable information, they exert comparatively little influence in determining the dose of irradiation. A dose is used which is considered to be large enough to effect a cure irrespective of the microscopic type of the lesion. A considerable margin of normal skin is included in the treated area.

2. Precancerous leukoplakia and keratoses, as a rule, are best treated by electrocoagulation. Individual areas of keratoses which appear to be undergoing malignant changes should be considered cancer and treated with large doses of irradiation.

3. Comparatively small basal- or squamous-cell carcinomas are treated with large doses of x-ray generated at low or medium voltage with little or no filtration.

4. Carcinoma involving cartilage, carcinoma of the lip, and the so-called "radioresistant" type of squamous-cell carcinoma are treated with x-rays generated at high voltage, 200 kv. or 220 kv., using heavy filtration. In some cases, small radium packs are preferred. In select cases, low intensity radium element needles, with heavy filtration, are used. In these cases, the interstitial radium dose is frequently supplemented by heavily filtered high voltage x-ray.

5. Each case of skin cancer must be individualized, and, as each case is carefully followed, the plan of treatment may have to be modified.

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THE USE OF 200,000 VOLTS IN THE TREATMENT OF ADVANCED SUPERFICIAL CANCER[1]

By JOHN T. MURPHY, M.D., *and* C. E. HUFFORD, M.D., *Toledo, Ohio*

FOUR thousand persons die each year in the United States from cancer of the skin (5). This fact, in a disease which is almost 100 per cent curable when properly treated, leaves much to be done in education.

Many forms of treatment have been successfully used in these conditions, including surgical removal, electric coagulation, caustics, radium, and x-ray. Failures may follow all of these methods, but are much more common when the procedure has been inadequate to eradicate the growth.

The technic often recommended, from 2,500 to 3,000 r, measured in air, of low voltage x-ray (100 kv. to 120 kv.), is, in our opinion, prone to failure because the dose is insufficient to destroy the growth. The administration of an erythema or suberythema dose at intervals of a week or two is equally ineffective.

It is customary in many places to rely upon the biopsy findings. A small piece of tissue is removed, and the amount of treatment to be used is determined by the type of cell found under the microscope. When a basal-cell lesion is discovered, a smaller dosage of x-ray is used than when a squamous type of cell is present. This we believe to be a mistake, because the biopsy does not always reveal the type of pathology in the entire growth. From 12 to 15 per cent of these basal-cell tumors will disclose squamous-cell areas (1).

In the treatment of the early cases we use unfiltered radiation, 120 kv., and give from 8,000 to 10,000 r divided into two to three doses.

The method that we have used in this series of advanced cases has been 200,000 volts, higher filtration, and division of dosage with a total exceeding, in most instances, 4,500 r.

It is not our intention to give a statistical report in this communication, but review a few cases, give the technic and illustrate the results, and point out some of the hazards and some of the poor results, as well as the good.

The method of choosing these cases for higher voltage therapy is somewhat arbitrary, and is more or less determined by the size and thickness of the lesion and the type of tissue involved, as in the following case.

Case 1. L. B., male, aged 83 years, presented himself on Sept. 18, 1937, with a raised ulcerated lesion on the left cheek, 5 cm. in diameter and about 1.5 cm. thick. This was at the margin of a former growth which had been treated twice, eight years before, with unfiltered x-radiation, using 120 kv. On each of these occasions, five months apart, the lesion had seemingly responded and disappeared after a relatively small dose of radiation.

The return of this lesion at the same site suggests the insufficiency of the former treatment, either as to size of application or amount of radiation.

Figure 1 is a photograph made on Sept. 25, 1937. Because of the size of the lesion, both in diameter and thickness, it was decided to use fractionated daily doses of x-radiation at this time which was administered with 200 kv., 50 cm. distance, filter of Thoraeus type (0.2 mm. Sn, 0.25 mm. Cu, 1.25 mm. Al), given at first in daily doses of 300 r for four doses, then 200 r daily up to a total of 4,400 r, using a 6 × 8 cm. field. After this, the field was decreased to 5 cm. in diameter and an additional 1,600 r were given at 200 r per day, making a total of 6,000 r, measured in air, in 32 days.

[1] Read before the Twenty-fifth Annual Meeting of the Radiological Society of North America, at Atlanta, Dec. 11–15, 1939.

The use of 300 r per day during the first few days, in this case four days, allows us to get in a somewhat larger total amount without unduly protracting the time.

The reduction of the size of the field toward the close of the treatment from a rectangle of 6 × 8 cm. to a circle 5 cm. in diameter, directly over the lesion, allowed a greater total dose to the lesion itself.

A photograph made on Oct. 20, 1937, the final day of treatment, showed the reaction at its height. The mass had begun to recede at this time. Ten days later, on Nov. 1, 1937, no evidence of the tumor was present. Fifteen days later, the reaction had healed to one-half its former size. Six weeks later, on Dec. 29, 1937, there was still an area not completely healed, with some induration at the upper mar-

Fig. 1.

Fig. 2.

Fig. 1. Case 1. L. B., aged 83 years. Sept. 25, 1937, lesion 5 cm. in diameter.
Fig. 2. Case 1. June 4, 1938, lesion healed.

Fig. 3.

Fig. 4.

Fig. 3. Case 2. J. B. C., aged 80 years. Aug. 12, 1937, lesion left side of lower lip, 2.5 × 5 cm. across.
Fig. 4. Case 2. Jan. 10 1938. lesion healed.

gin. This had all disappeared, however, by March 28, 1938, about five months after the close of treatment.

By June 4, 1938, all evidence of the disease had disappeared (Fig. 2).

Frequently a carcinoma of the lip is encountered which has been neglected and gone beyond the stage of probable satisfactory treatment by the usual unfiltered radiation technic. The following case was such. Though this might be considered a borderline case and be treated with unfiltered radiation, we chose to use higher voltage and divided doses.

Case 2. J. B. C., male, aged 80 years, came to us on Aug. 10, 1937, with a large ulcerated cauliflower-type lesion on the left side of the lower lip, about 2 cm. thick and 2.5 × 5 cm. across. The lesion is shown in a photograph made Aug. 12, 1937 (Fig. 3). No palpable lymph nodes were found in the vicinity.

A biopsy specimen was taken and treatment was started immediately (Fig. 5).

The pathologic report reads as follows: "The sections show acanthosis of the surface epithelium with irregular cell masses proliferating and infiltrating an inflammatory fibrous stroma. There is considerable keratinization and small whorls of cells are present, resembling epithelial pearls. There is considerable erosion and necrosis in areas." Diagnosis: "Keratinizing squamous-cell epithelioma with inflammatory stroma."

Treatment was begun by giving 300 r per day for five days and then 200 r daily for a total of 5,900 r in 32 days. This was given through an oval port about 4 × 5 cm. in size, with 200 kv., 50 cm. distance, filter of Thoraeus type (0.2 mm. Sn, 0.25 mm. Cu, 1.25 mm. Al). The reaction was never very sharp and on Sept. 20, 1937, healing was observed. Observations every two weeks showed continued healing, although about two months later a small area in the center remained unhealed.

On Dec. 11, 1937, the center showed some hardness. On Jan. 10, 1938 (Fig. 4), the lesion was completely healed and the patient has remained well.

In the large lesions involving cartilage, the protracted fractionization method of treatment, with higher voltage and higher filtration, offers, at present, the best method of attack. In the past the fear of producing chronic painful ulceration with incomplete tumor destruction has deterred many men from irradiating lesions in which cartilage is involved, when the medium at hand was lightly filtered or unfiltered x-ray. The advent of heavier voltage and higher filtration, with fractionization of the dose, has helped to solve this problem (2).

Case 3. J. S., male, aged 73 years, was referred on July 30, 1937, for treatment of a large cauliflower-type growth on the helix of the right ear. It was about 3 cm. in diameter and very thick.

Daily doses of 300 r each for four days were given and then 200 r daily. A total of 5,200 r, measured in air, was administered in 28 days. Factors were 200 kv., 50 cm. distance, filter of Thoraeus type (0.2 mm. Sn., 0.25 mm. Cu, 1.25 mm. Al) through a circular port 5 cm. in diameter.

Four days subsequent to the last treatment (Sept. 30, 1937), the reaction was not so marked, but the mass of the growth had disappeared.

Seven weeks later the ear had healed completely. The patient complained of deafness on this side which he had noticed

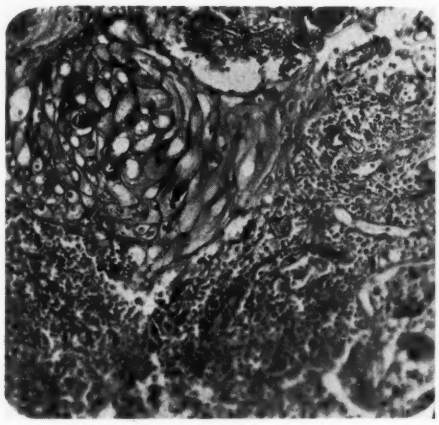

Fig. 5. Case 2. Photomicrograph of keratinizing squamous-cell epithelioma with inflammatory stroma.

for two weeks previously. The hearing improved, however, and four months subsequent to the treatment was apparently normal. The ear has remained well.

The seriousness of all lesions about the ear is well recognized, and Pfahler (5) has gone so far as to say, "A greater percentage of failures occur in the treatment of cancer in the region of the ear than any other superficial portion of the body."

The difficulties encountered in lesions about the nose involving cartilage may give even more trouble, especially if complicated by infection.

Case 4. N. M., male, aged 48 years, was first treated, in 1928, for a small erosion about 3/8 in. in diameter over the left side of the tip of the nose. The blood Wassermann was negative.

A relatively small dose of unfiltered radiation was given at that time, with apparent destruction of the lesion.

About a year later (October, 1929), there was a return of the ulceration and a small amount of treatment was again given, which resulted in disappearance of the lesion.

Four months after this there was a recurrence. A somewhat larger dose of unfiltered radiation was given. The response was good, but five months later the margins of the area again broke down, and a series of ultra-violet light treatments was administered with unsatisfactory results, though some healing took place.

Fifteen months later, on Aug. 24, 1932, biopsy showed a squamous-cell epithelioma. A fairly heavy dose of unfiltered radiation was administered. Healing followed and four months later the area appeared in fairly good condition.

Nine months after this, in May, 1933, there was evidence of recurrence at the lower margin of the old lesion. Again unfiltered radiation was given over the recurrent area. The patient remained under observation for three months with progressive improvement, after which he disappeared and did not return until June, 1938, five years later (Fig. 6). At this time the nose was almost completely destroyed, with involvement of the upper lip on the left and extension almost to the lower eyelid on this side.

On pathologic examination sections at this time showed "acanthosis with a moderate degree of hyperkeratosis at the margin of an ulcerated area. This area shows

Fig. 6.

Fig. 7.

Fig. 6. Case 4. N. M., aged 58 years. June 29, 1938, nose almost completely destroyed, with extension to lower left eyelid and involvement of upper lip on left.

Fig. 7. Case 4. Nov. 3, 1939. No evidence of tumor. Infection still present. Portions of maxillary and left nasal bone exposed.

proliferating basal-type cells infiltrating a hyalinizing connective tissue stroma." Diagnosis: "Basal-cell epithelioma." (See Fig. 8.)

Fractionated doses of x-ray were given, 200 r per day, using 200 kv., 50 cm. distance, filter of Thoraeus type (0.2 mm. Sn, 0.25 mm. Cu, 1.25 mm. Al) up to a total of 6,200 r in 35 days.

This was followed by three doses of 270 r each at 40 cm. distance through a 3-cm. cone over the margin of the lesion, bringing the total to about 7,000 r, measured in air, in 39 days.

The usual reaction followed, and then marked healing in about one month.

An examination made on Dec. 30, 1938, revealed no evidence of tumor. Part of the left nasal bone and portions of the maxillary bone were exposed. Saline packs were applied daily with slow lessening of the infection.

In May, 1939, practically all the infection had disappeared, but there was a small recurrent nodule of tumor tissue at the outer lower corner of the old lesion. This was treated with unfiltered radiation, using Chaoul technic and giving 9,750 r, measured in air, to an area 2 cm. in diameter.

Disappearance of this lesion followed, but there still remains considerable evidence of infection with some sequestrating exposed maxillary and nasal bone present (Fig. 7).

Failure may occur in some of these cases because of extension to lymph nodes. This fact is illustrated in the following case.

Case 5. L. B., female, aged 79 years, was referred to us on June 9, 1938, with an ulcerated lesion on the right side of the neck just below the angle of the jaw, which was about 2.5 × 4 cm. across (Fig. 9). She had previously received occasional small doses of lightly filtered x-ray before coming to us.

Biopsy was taken and treatment started at once.

The pathologic report read as follows: "The sections show thickening of the surface stratified epithelium with masses of anaplastic squamous-type cells invading the underlying stroma." Diagnosis: "Anaplastic epidermoid and prickle-cell carcinoma." (See Fig. 11.)

Treatment was given through a port 4 × 5 cm., at 50 cm. distance, 200 kv., filter of Thoraeus type (0.2 mm. Sn, 0.25 mm. Cu, 1.25 mm. Al), giving 300 r daily for four days, then 200 r per day up to a total of 6,800 r in 37 days.

On July 25, 1938, nine days after the close of the treatment, there was a marked reaction of the skin.

One month later the skin was almost healed and there was no evidence of the growth.

Two months later the skin was completely healed and the growth was apparently gone (Fig. 10).

Frequent observations revealed no change until May 23, 1939, seven months later, when there was found a recurrence in a deep gland in the right side of the neck just below the original area. The port had been too small, though the original lesion had been completely destroyed.

Treatment was given over the involved gland using a 6 × 8 cm. field and the usual factors, giving 200 r per day to a total of 5,740 r in 30 days.

Reaction and healing progressed normally. However, about three weeks following the close of the treatment, a small mass, about 2 × 2 cm., was noted over

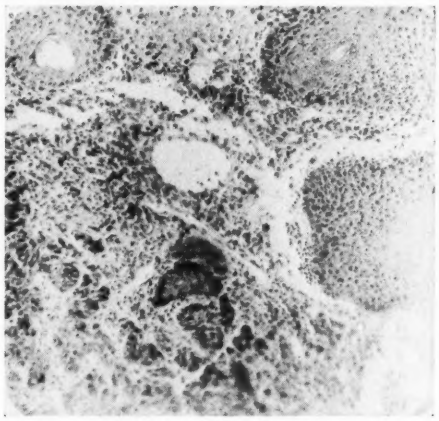

Fig. 8. Case 4. Basal-cell epithelioma.

the anterior mid-portion of the sternomastoid muscle.

With the healing of the skin reaction, the mass appeared to become slightly smaller, but persisted. About two months later, on Aug. 30, 1939, it was decided to treat this mass with a 3.5-cm. cone, 40 cm. distance. Four treatments were given, 200 r each, but the patient's general condition was poor and she failed to return. She died two months later.

Though this was a highly anaplastic squamous-cell carcinoma, the likelihood of a recurrence would have been much less, we believe, had the original port been larger and had it included the regional lymph nodes in the immediate vicinity.

Because of the greater penetration of this type of radiation (6 and 3), it is essential that there be ample protection of underlying structures such as the alveolar process of the mandible in treating carcinoma of the lip, as in the following case.

Fig. 9.

Fig. 10.

Fig. 9. Case 5. L. B., female, aged 79 years. June 9, 1938, lesion right side of neck, 2.5 × 4 cm. across. Previously received small doses of lightly filtered x-ray elsewhere.

Fig. 10. Case 5. Oct. 24, 1938, skin completely healed and growth apparently gone. Seven months later, on May 23, 1939, there was a recurrence in the deep gland in the neck, just below the original area.

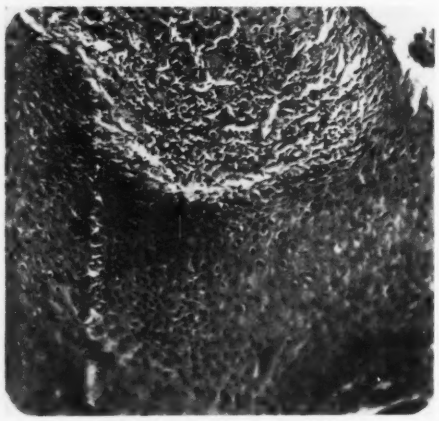

Fig. 11. Case 5. Photomicrograph of anaplastic epidermoid- and prickle-cell carcinoma.

Case 6. S. K., male, aged 56 years, was referred for treatment of an extensive fulminating growth involving almost the entire lower lip. It was 2 cm. thick, 2.5 cm. wide, and 5 cm. long (Fig. 12).

Because of the extensive involvement, treatment was started at once and biopsy was not taken until later.

The pathologic report was as follows: "Squamous-cell epithelioma showing retrogressive changes and cell degeneration, apparently due to radiation, and with granulomatous inflammation in the underlying stroma." (See Fig. 14.)

Treatment was given at the rate of 200 r per day, 50 cm. distance, filter of Thoraeus type (0.2 mm. Sn., 0.25 mm. Cu, 1.25 mm. Al), to a total of 6,000 r, measured in air, in 34 days through an oval field exceeding the size of the lesion by about one centimeter.

Three days subsequent to the last treatment, it was observed that the tumor mass was practically gone and the mucositis had definitely subsided. Healing progressed normally. About the time this was complete, it was noted that the lower incisor teeth were loosening and necrosis of the alveolar structures was appearing.

It was now unmistakably evident that the alveolar process had not been sufficiently protected by the lead margins of the port, though the direction of the x-ray beam had always been downward and tangential to the mandible.

A severe osteomyelitis of the jaw followed, with loss of the teeth and sequestration of most of the alveolar process. Months were required for the cleaning up of this condition and now, about one year later, the mouth appears normal (Fig. 13). There has been no evidence of return of the tumor.

Cases showing mixed basal- and squamous-cell proliferation with changes simulating adamantine epithelioma may give considerable trouble. We have had two such cases, both of which were far advanced and had been grossly neglected. Both patients have had recurrences of their growths.

Case 7. P. M., male, aged 55 years, had an extensive ulcerative eroding lesion of the right upper lip.

The growth involved the right corner of the mouth, infiltrating the cheek in all directions (Fig. 15). The right half of the upper lip was completely eroded with induration extending to the left of the midline. The gum in the right incisor and cuspid areas was gone, with exposure of the greater portion of the roots of these teeth.

Biopsy specimens were taken from two areas of the upper lip. The pathologic diagnosis was: "Epithelioma of the squamous- and basal-cell types with cell arrangement in the deeper areas simulating adamantine epithelioma." (See Fig. 18.)

Fig. 12.

Fig. 13.

Fig. 12. Case 6. S. K., aged 56 years. Sept. 16, 1938, lesion on the lower lip, 2.5 cm. wide and 5 cm. long.
Fig. 13. Case 6. Dec. 2, 1939, lesion healed. Deformity of the lower jaw following sequestration of alveolar process.

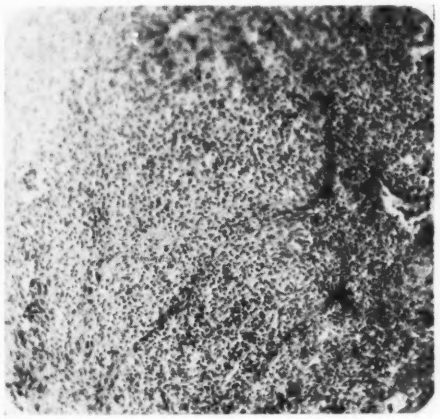

Fig. 14. Case 6. "Squamous-cell epithelioma showing retrogressive changes and cell degeneration, apparently due to radiation and with granulomatous inflammation in the underlying stroma."

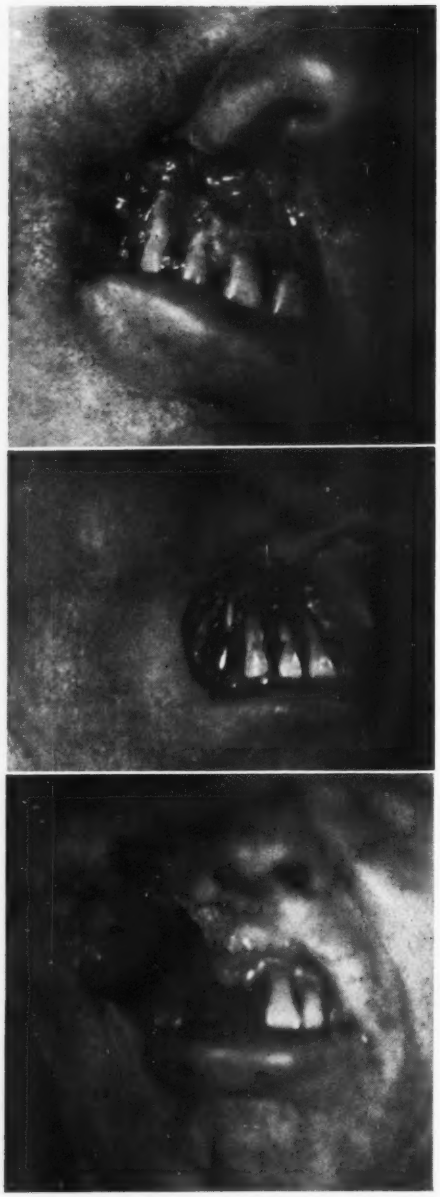

Fig. 15 (*upper*). Fig. 16 (*center*). Fig. 17 (*lower*).

Fig. 15. Case 7. P. M., aged 55 years. June 17, 1937, growth involved right corner of mouth. Erosion of right half of upper lip. Loss of gum with exposure of roots of incisor and cuspid teeth.

Fig. 16. Case 7. Dec. 5, 1937. No evidence of tumor.

Fig. 17. Case 7. Dec. 4, 1939. Reaction following recent unfiltered radiation on recurrent nodules at margin of cheek and on alveolar process.

A blood Wassermann report was negative.

For two days 300 r were given and then daily doses of 200 r up to a total of 5,200 r, measured in air, in 29 days. An oval port was used, going well beyond the margins of the growth on all borders. Factors were 200 kv., 50 cm. T.S.D., filter of Thoraeus type (0.2 mm. Sn, 0.25 mm. Cu, 1.25 mm. Al).

One week subsequent to the last treatment there was a uniform moderate reaction. Healing had begun at three weeks and continued satisfactorily (Fig. 16). At the six-month period, in January, 1938, the lesion appeared healed and there was no evidence of the growth.

Three months later, on March 28, 1938, there was a small recurrence at the border of the old lesion on the left upper lip. This was treated with unfiltered x-radiation giving 3,780 r on the first day and 1,890 r one week later. The factors were 120 kv., 25 cm. distance, no filter.

This recurrence responded promptly and had completely healed and disappeared without evidence of disease three months later.

His condition remained satisfactory for nearly 14 months, when there appeared some evidence of infection about one of the exposed teeth.

Saline packs were used and some of the

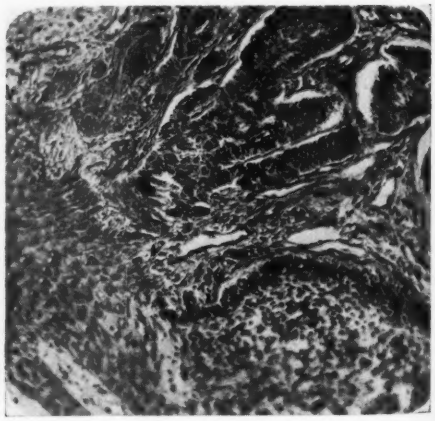

Fig. 18. Case 7. Photomicrograph of epithelioma of the squamous- and basal-cell types with cell arrangement in the deeper areas simulating adamantine epithelioma.

teeth were removed. Some improvement followed, but it became evident again in three months, late in October, 1939, that there was newgrowth recurring on the posterior alveolar margin. Sections were taken and basal-cell carcinoma with a fibromyxomatous stroma was reported.

This has again been treated with 9,000 r of unfiltered radiation and is at present showing the usual escherotic type of reaction (Fig. 17).

In the presentation of these cases we have tried to point out only a few of the problems that have confronted us in this type of therapy and we offer the following conclusions.

CONCLUSIONS

1. Adequate treatment of early cases of superficial malignancy will avoid the necessity of using the method we are now employing.

2. A dose of 200,000 volts, with proper filtration, offers a method of treating advanced skin cancer with the hope of curing some of them.

3. Fractionization of dosage with proper filtration allows a uniform lethal tumor dose to be administered without unduly sacrificing recovery ability of normal tissue.

4. The reactions which are produced by this type of irradiation are marked enough to produce a severe epidermitis without permanent injury to the underlying corium. The skin heals with a soft texture with no rigidity or induration.

5. The height of the reaction, in our experience, is usually reached from four to six weeks after treatment is started, or, in other words, in most instances, from ten days to two weeks after radiation is stopped. However, the tumor mass itself may rapidly regress during the course of the treatment, often disappearing completely by the close of the treatment. Complete healing has, in most instances, required from two to four months after the cessation of treatment.

6. This method, while giving good results in a wide range of cases, may not answer the requirements in certain cases of complicated disease, and other accessory forms of treatment may be necessary.

7. In effective treatment of skin cancer, little significance can be placed on the type of cellular growth. From 10 to 15 per cent show both basal- and squamous-cell proliferation. The amount of treatment must be sufficient to be lethal to all tumor cell types.

SUMMARY

1. Seven cases of advanced cancer of the skin are reviewed, in which irradiation treatment was employed using 200,000 volts, 50 cm. T.S.D., and filter of Thoraeus type (0.2 mm. Sn, 0.25 mm. Cu, 1.25 mm. Al).

2. Two cases are reported which are considered average, in which the choice of therapy was based largely on the dimensions of the lesion.

3. Two cases offered a hazard to successful treatment in the form of closely underlying cartilage.

4. Three cases are presented in which the results were poor or unsatisfactory: one in which the port was too small; one in which there was a prolonged recovery and complicating osteomyelitis due to lack of proper protection; one in which the type of disease was apparently responsible.

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DISCUSSION

JOHN T. MURPHY, M.D. (Toledo, Ohio): I am glad to be the first to congratulate Dr. Bogart on his paper and on his presentation.

Dr. Widmann, in a meeting in Chicago last year, advocated a highly scientific treatment of superficial cancer. By the size of the lesion, the type of pathology, and many other things, dosage is determined. It is all very interesting to me because, back in 1915, I talked to Dr. Grier and he told me what he was doing with superficial cancer. It sounded crazy, but we started doing it. As soon as the Coolidge tube was introduced and we had a better method of controlling dosage, we knew more what we were doing.

But, figuring back, Dr. Grier and Dr. Johnston in those days were giving approximately 10,000 r to superficial lesions, and getting results which nobody else was getting. There was not any question about it. I saw their cases and their work. So, I started to use it and I am here to-day to call attention to what, I believe, is the danger of using doses of 2,500, 3,500, or even 4,500 r to superficial cancer.

I think many persons will get well, but many of them will not. That case of nose cancer which we showed you was treated by me with some of those doses. I did not have nerve enough. The lesion was so small. That shows the results obtained if you do not hit them hard enough. I think this case would have stayed perfectly well if we had had sufficient radiation over the first lesion and an area large enough to include the whole region. Many failures are due to neglect to include a field large enough to get the entire lesion. I am simply making a plea for the use of larger doses of unfiltered radiation in smaller lesions because I believe a larger number of patients will remain well, and there are no ill effects from that type of dosage.

J. M. MARTIN, M.D. (Dallas, Texas): We have several roads coming into Atlanta, and I know that some of them are very good. If you drive carefully and observe the traffic rules, you will arrive in Atlanta all right. I might say the same thing about treating cancer with x-rays and radium. You must know what you are doing and how to do it. You can make changes and variations in technic, if you know how, and get equally good results.

I want to compliment Dr. Bogart on his results: they are exceedingly good. I want to suggest to him that when implanting the radium platinum needles about the face and neck, in place of allowing the threads attached to the needles to lie about over the surface, gather them into one hand, twist them into a small rope which, in turn, is fastened to the printed safety tag, as he is now doing. When leaving the threads scattered over the surface, patients are prone to pick at them and, by so doing, pull the needles out of the tissues.

When inserting the radium platinum needles in the tissues, they must be placed parallel to each other and not more than 1 cm. apart. Doctors are not all good mechanics. It is a difficult matter to take a blunt pointed needle in a pair of forceps and insert it in the tissues in perfect alignment with other needles.

Like Dr. Bogart, we still find it necessary to make an x-ray plate after the needles have been inserted to determine whether or not the pattern is correct. When the needles are not long enough to reach all of the tumor, other needles must be inserted at the ends of the first needles and at right-angles to them.

When treating metastatic glands with radium needles, we endeavor to produce in the tissues nine threshold erythema doses. However, this is not enough to destroy cancer of this type. We are, therefore, supplementing the radium treatment with four erythema doses of x-rays, 2,100 r. Dr. Bogart is using 2,500 r, which is not too much.

Dr. John Murphy said a while ago that you can do a lot of things if you try. You can use a great deal more treatment than is necessary and get away with it. Usually, the tissues will withstand a considerable

degree of over-treatment without damage. Cases which have been under-treated do not usually respond satisfactorily to a second series of radiation. It is because of this fact that I do not like to treat a patient who has had previous treatment. When working over a fibrotic area which has failed to heal, we are likely to get into trouble.

I want to thank Dr. Murphy for the splendid work he and his group are doing. He mentioned what I call "second-degree" or "second-stage" lesions. For convenience and to keep the record straight, I divide all superficial carcinoma into first, second, and third stages. I cannot draw a line between them, further than to say that all third-stage lesions metastasize while those in the other stages do not.

I wish I had brought to this session a few slides I have in my room illustrating this type. Dr. Murphy's results are wonderful. It does my heart good to see the splendid work being done throughout the country. We all realize that thousands of persons, in spite of our wonderful equipment, are dying every year from cancer. Hundreds and hundreds of doctors are neglecting the early stages of cancer and are allowing it to get into the advanced or incurable stages. You see many cases with one and sometimes both feet in the grave and you put up a desperate fight for them. Once in a while you succeed in curing a patient or in prolonging the life of one of these desperate cases. If you work in a free tumor clinic, as we do, you see a number of cases of this type. We must do our duty and fight for these cases as hard as we can. We all know that some of the seemingly impossible cases get well, and then the surgeon will sometimes say, "Well, that was a wonderful result, but it couldn't have been cancer."

S. S. MARCHBANKS, M.D. (Chattanooga, Tenn.): I would like to ask this question: What about the effect on the underlying bone in these metastases, especially with high voltage?

DR. BOGART (*closing*): I want to thank Dr. Martin for emphasizing what I tried to bring out about the arrangement of the needles. I chose to report one of the first cases which I treated in order to show the mistakes which had been made, in the hope that others might avoid them. The needles should be placed as Dr. Martin described, and, as I stated, parallel, and the whole growth should be covered.

When I treat a skin cancer I prefer to use from 5,000 to 6,000 r and up. As has been mentioned before, I feel that it is better to give a little too much irradiation than too little. Unnecessarily large doses should, of course, be avoided.

The thing I want to emphasize in the whole paper is to individualize the case, to select the method of treatment, and to keep the patient under close observation for a long period of time so that the original treatment may be supplemented if necessary.

DR. HUFFORD (*closing*): I just want to say to Dr. Marchbanks that we have worried about the effect on the underlying bone in these cases. In the particular one which I showed, there was a definite necrosis of the alveolar process, which we felt was a mistake on our part. We had not protected the bone sufficiently, together with the fact that the patient had badly infected teeth, which predisposed to necrosis.

In answer to Dr. Martin's idea of smaller doses being sufficient in these cases, we have found that with the larger doses we get satisfactory cosmetic results, with fewer recurrences.

FURTHER OBSERVATIONS ON ELIMINATION OF INTESTINAL GAS SHADOWS IN ROENTGENOGRAPHY[1]

By JAMES E. LOFSTROM, M.D., *Detroit, Michigan*

From Wayne University College of Medicine, Receiving Hospital, and Alexander Blain Hospital

FROM the time roentgen studies were first utilized as a method of observing the gall bladder and the genito-urinary tract, intestinal gas shadows have been disturbing elements on the roentgenogram. Every conceivable method has been clinically evaluated in an attempt to eliminate these shadows, which cause immeasurable confusion and errors of interpretation. Use of catharsis by administration of compound licorice powder, castor oil, and enemas has found wide use in the past. Regardless of the fact that many roentgenologists and urologists have felt, as we do, that there is more often an increased production of gas rather than an elimination, all of these measures have been tolerated because of the lack of anything better. Only recently has a real advance been made in overcoming this long-standing problem.

In a recently published article, we described a method of eliminating objectionable intestinal gas shadows in roentgenography. At that time we reviewed results in a large series of patients who were subjected to roentgenologic study following the use of pitressin as a pre-examination agent. Continued use of the drug in an additional 1,000 cases, as a routine method of preparation, has convinced us that there is no other means at our disposal which will even approximate it in efficiency.

Pitressin was isolated in 1928, and is the pressor principle of the pituitary gland. Combined with the oxytocic principle (alpha hypophamine), which acts on the uterine musculature, it appears as pituitrin. This latter drug had been used intermittently by many persons in attempts to discover a gas-dispelling agent; no amount of success has ever accompanied its use. The oxytocic element is too often contraindicated.

Pitressin, on the other hand, lends itself distinctively to use in the field of roentgenology. Its action is primarily on the smooth muscle of the intestinal tract and it is this factor that establishes its efficacy. The stimulation of the smooth muscle of the bowel with increase in muscular tonus induces elimination of feces and gas, thereby removing objectionable shadows and permitting satisfactory clarity on the roentgenogram.

After rather sensational results in a few cases first studied in 1934, more careful analysis of the action of pitressin was undertaken and a method of administration was outlined. This was varied at intervals until what we considered the most effective combination of factors was achieved.

Administration.—The following is the routine described in our previous paper; it has been in use at Receiving Hospital and the Alexander Blain Hospital for over two years.

The night before examination, a cleansing enema is given.

This is followed, in the morning, about one and one-half hours before the time set for roentgenography, by another enema.

One hour before examination, 0.5 c.c. (10 units) of pitressin is given intramuscularly and repeated in one-half hour.

No cathartic is administered.

Care should be taken that not more than 30 minutes elapse after the last injection before the roentgenologic study is carried out. An optimal effect is obtained in from 15 to 30 minutes, as will be pointed out

[1] Accepted for publication in August, 1939.

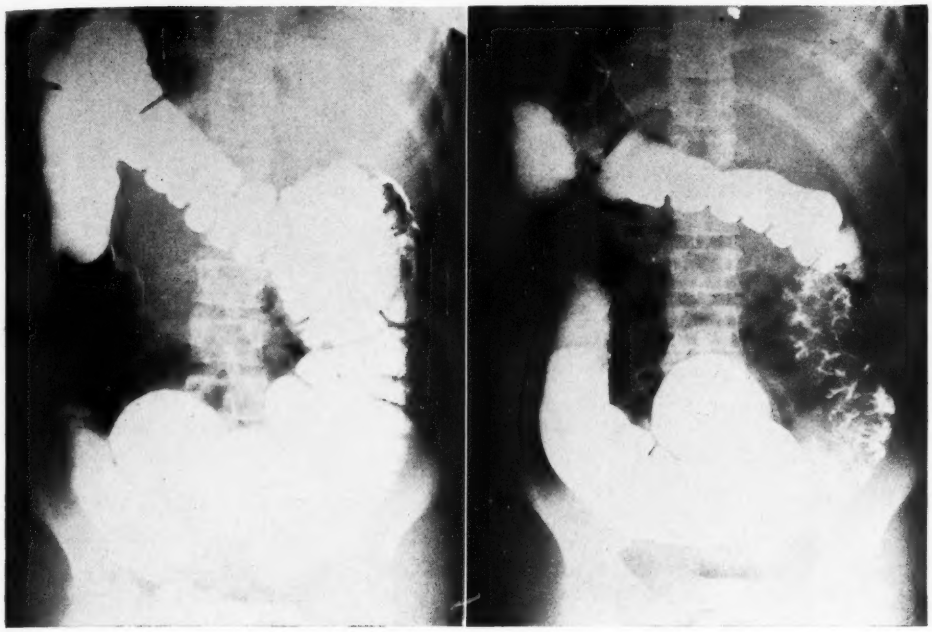

Fig. 1-*A*. Fig. 1-*B*.

Fig. 1-*A*. A dilated colon filled with barium obliterating the kidney and gall-bladder areas.
Fig. 1-*B*. Roentgenograph taken five minutes after the intramuscular injection of 20 units of pitressin. Note the site of origin of mass action in the cecal area. The film was taken immediately after the patient complained of cramps.

later in detail. After this time there usually begins a re-accumulation of gas in the bowel.

Various modifications of the method may be employed when necessary. The above routine is that which we use in all cases which are scheduled for roentgen examination in advance. When such a situation is not possible and time is a factor, only the morning portion need be carried out. The enema may be eliminated if necessary, but, as has been previously stated, the enema is important since the drug seems to have a slightly greater action on the overfilled colon than on the colon containing normal amounts of fecal matter. Also, liquid contents may be more easily forced along than is solid fecal matter. When it is desirable and necessary to have rapid action and the enema is impracticable, pitressin may be used alone. Such cases should receive the full 1 c.c.

Fig. 1-*C*. Roentgenograph taken 15 minutes after the injection of pitressin shows nearly complete evacuation with retraction of both flexures of the colon visualizing the gall-bladder and kidney areas.

Fig. 2-*A*.

Fig. 2-*B*.

Fig. 2-*A*. The colon filled with barium solution partially obliterating the gall bladder and completely obscuring the kidney areas.

Fig. 2-*B*. Roentgenograph taken five minutes after the intramuscular injection of 20 units of pitressin shows the mass action beginning just above the cecum.

Fig. 2-*C*. Roentgenograph taken 20 minutes after the injection gives good visualization of the gall-bladder and also the kidney area. Note retraction of the flexures of the colon.

dose (20 units) of the hormone. This is often used in gall-bladder examinations, without previous preparation, in which the hepatic flexure is masking the shadow of the viscus or causing other confusion. Also, we have been able to do cholecystographic studies immediately following a gastro-intestinal series regardless of the opaque barium in the colon.

Site of Action.—By means of both fluoroscopic and roentgenographic methods, visible proof of the action of pitressin was sought. A series of studies were carried out on apparently healthy, normal adults who had been given a barium sulphate meal followed by intramuscular injections of pitressin given at intervals. At no time were we able to detect any definite reaction upon the stomach, in regard to peristaltic activity or emptying time. At first it was felt that there was a slight accentuation of peristalsis but continued efforts failed to substantiate this viewpoint. No apparent change in emptying time was noted. We have, therefore, concluded that there is minimal or no visible effect on the stomach of the normal adult. Injections given after the meal had passed as far as the ileum produced an apparent increase in the tone of the ileum, although no increased activity was especially noticeable. We can, therefore, conclude that the action of pitressin on the jejunum and ileum is similar to its action on the stomach, when used in the case of an indi-

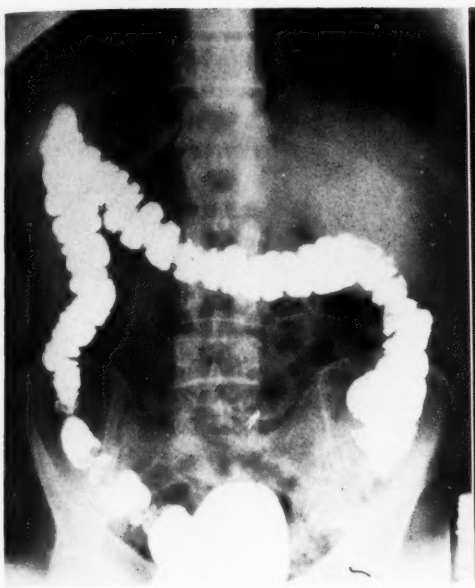

Fig. 3-*A*.

Fig. 3-*B*.

Fig. 3-*A*. Colon filled with barium solution.
Fig. 3-*B*. Roentgenograph taken 15 minutes after the intramuscular injection of 20 units of pitressin shows mass action again originating just above the cecum before evacuation.

vidual in good health. This, however, will not hold true in cases in which the small bowel is abnormally distended. When the lumen of that segment of the intestinal tract is inflated, due to stasis, paralysis, or obstruction, a pronounced effect will be forthcoming, with resultant increased tone and collapse of the lumen. This is apparently what is often noted by some authors when pitressin is injected into anesthetized patients on the operating table. The action in such cases is upon a bowel which is under abnormal conditions; a similar state occurs when enclosed gas shadows are apparent in the small bowel during roentgenography.

Further studies were carried out on the colon of both normal and abnormal individuals, following the filling of the large bowel by the usual opaque clysma. Under fluoroscopic observation the colon was completely filled and 1 c.c. (20 units) of pitressin was injected intramuscularly. The first signs of action were noted in from five to ten minutes, depending on the tonic condition of the bowel. The site of primary activity was noted to be in the ascending colon, well proximal to the area

Fig. 3-*C*. Roentgenograph taken 20 minutes after injection shows nearly complete evacuation with mass action still in progress.

where the normal mass actions begin in the vicinity of Cannon's tonic ring. A wave of contraction was seen to develop ing of the longitudinal measurement as well as generalized diminution of the lumen. This was accompanied by withdrawal of

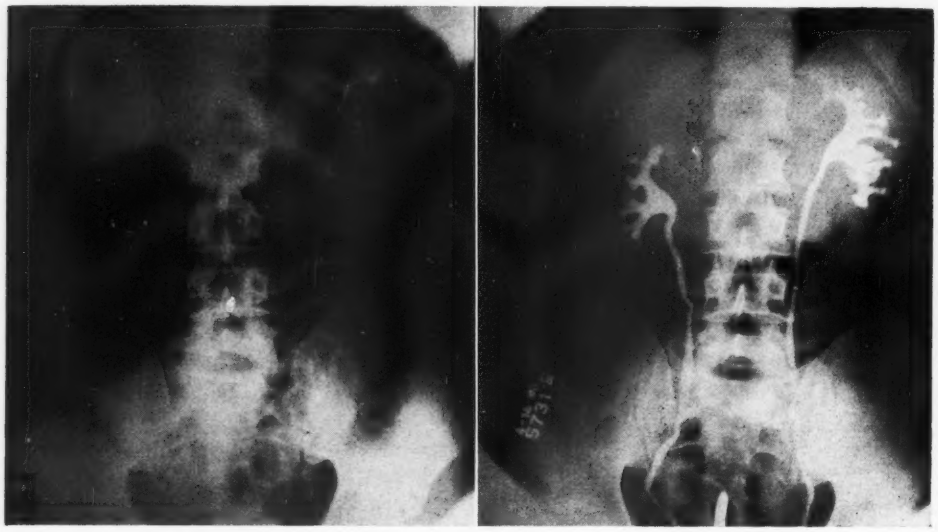

Fig. 4-*A*. Fig. 4-*B*.

Fig. 4-*A*. Roentgenograph taken preliminary to urography before preparation. Note diffuse gaseous distention of small bowel and colon.

Fig. 4-*B*. Roentgenograph of the same patient taken after preparation by the usual method shows complete elimination of colonic and small intestinal gaseous collections, permitting a satisfactory urogram.

just distal to the cecum and progress in an intermittent character at first, and, finally, in a continuous manner toward the rectum. After the contents distending the lumen had been forced along, a tonic state developed with nearly complete collapse of the colon. Visible contractions were accompanied by a slight feeling of spasm on the part of the patient. When the bowel was of a particularly atonic type with diminished haustrations, a slightly longer time elapsed before the initiation of peristaltic activity in the colon. The patient was usually able to control retention of the enema for a period up to five minutes after the first feeling of cramps; it was usually impossible for him to retain it longer. Serial films were made and are herewith reproduced.

Indications.—Upon observing the reaction of the colon to the hormone, it was found that there was considerable shorten- the hepatic flexure out of the right upper quadrant area, which is the normal situation of the gall bladder; this is the result that must be obtained to visualize properly that viscus. Our routine use of this method of preparation has demonstrated that there is no other which will accomplish this retraction with regularity. Collins, and others, have described the use of this hormone in cholecystography with equally good results. A small gas pocket in the hepatic flexure of the colon or in the small bowel, when superimposed upon the gall bladder, may completely obliterate that viscus or, on the other hand, give shadows which may be misinterpreted as negative-shadow or cholesterin stones. By using pitressin we have completely eliminated this difficulty.

It might be well to state at this point that we have carried out studies on the gall bladder, visualized in the usual man-

ner, to determine whether or not pitressin acts directly upon that structure. Films taken both before and after the injection of 1 c.c. (20 units) of pitressin intramuscularly failed to show any decrease in size of the viscus or evidence of contraction waves. At no time have we been able to discover any contra-indication to the use of the hormone on the basis of either accelerated or delayed emptying.

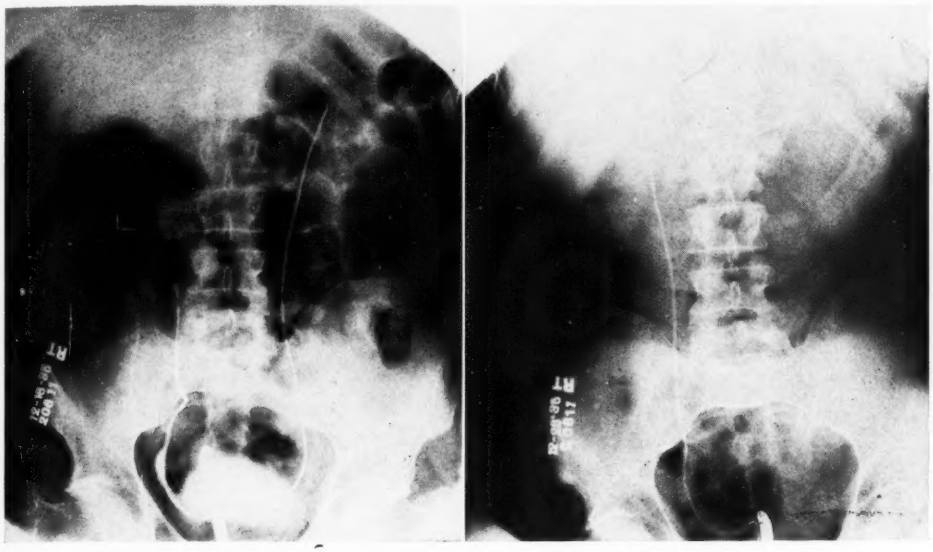

Fig. 5-*A*. Fig. 5-*B*.

Fig. 5-*A*. Pyelogram attempted without proper preparation shows marked distention of the colon with confusing shadows due to fecal contents.
Fig. 5-*B*. Examination repeated after routine preparation with pitressin shows elimination of all confusing gas and fecal shadows.

The general elimination of the colonic gas shadows is not only of value in the cholecystographic studies, but also in various types of urography. When the kidneys, ureters, and bladder are studied for the presence of stones, tumor, perinephritic abscess, etc., clarity of the roentgenogram is often obscured by superimposed gas or fecal shadows. When this routine method of preparation is used, however, such confusion is eliminated and clear-cut shadows are available for accurate study. The splenic flexure is often retracted to such an extent that it will lie below the level of the left kidney and, even though it may be superimposed on the kidney, the collapse of the lumen makes its presence not at all objectionable.

In intravenous urography we are called upon to interpret shadows which are not always of optimal density. The presence of a small amount of intestinal gas or feces may completely obscure the diagnosis. We have, therefore, found the use of pitressin in such instances to be of immeasurable value. In retrograde pyelography, on the other hand, we do have shadows of better density. However, the trauma of cystoscopy and catheterization often adds, to the normal distention of the bowel, an element of low grade ileus with excessive gas formation. Such a process may be overcome by the use of pitressin, thereby providing the sharpest possible detail.

When the question of skeletal metastasis and bone pathology of an infectious nature

arises in regard to the lumbo-sacral spine and pelvis, there is often great difficulty in distinguishing shadows present on the

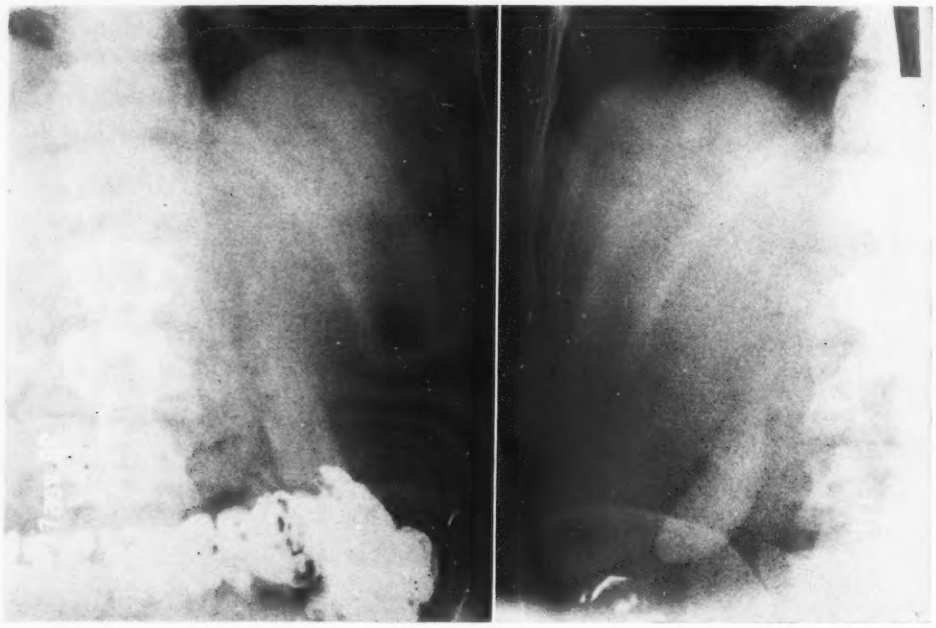

Fig. 6-*A*. Fig. 6-*B*

Fig. 6-*A*. The gall bladder outlined by dye with the barium-filled colon overlying the viscus.
Fig. 6-*B*. Roentgenograph taken 30 minutes after intramuscular injection of 10 units of pitressin giving clear gall-bladder image, the hepatic flexure having been retracted and emptied. Note that there is no attempt at emptying of the gall bladder from pitressin stimulation.

plate. Gas may simulate osteolytic areas or mixed fecal matter and may obscure other types of bone reaction. We have, on many occasions, had these patients return for examination after proper preparation to find our problems solved. If there is limited time available, simply give one ampule of pitressin (20 units) and watch for shifting of the shadows, even if they are not entirely eliminated.

Continued use of this method has produced no instances of severe systemic reaction which would contra-indicate its routine use. We are particularly cautious in the face of marked hypertension, evident coronary disease, or an acute complete intestinal obstruction. One should not become alarmed at the transient feeling of weakness and nausea or at the accelerated pulse and cold perspiration that is sometimes encountered. These are all fleeting in character and are never of such severity as to cause harm. The blood pressure may be observed to rise slightly, remain unchanged, or fall a few millimeters. In all studies carried out rather extensively by other workers, such changes seem to be about equally divided. Action on the uterus need not be contemplated since the oxytocic principle is not present in this preparation.

In conclusion, we can say that this method of eliminating intestinal gas shadows preparatory to roentgenography is the most successful we have yet encountered; it far surpasses the older methods using catharsis. It is safe, economical, and certain in at least 90 per cent of cases. Repetition of the dosages mentioned has been carried out frequently and with no difficulty.

SUMMARY

1. Further studies on the action of the pressor principle of the pituitary extract, pitressin, are reviewed.

2. The use of pitressin in roentgenography for the elimination of gas shadows is presented.

3. Indications, contra-indications, and methods of administration are restated.

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ROENTGEN DIAGNOSIS OF POSTERIOR DISLOCATION OF THE SHOULDER[1]

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IT is the purpose of this paper to emphasize the following features in the diagnosis of posterior dislocation of the shoulder:

(1) That clinically the diagnosis is difficult;

(2) That roentgenographically the diagnosis is practically always missed on the simple anteroposterior or postero-anterior views;

(3) That the use of several special diagnostic aids may suggest the diagnosis on the simple anteroposterior or postero-anterior views and permit a definite diagnosis on the stereoscopic examination;

(4) The value of the vertical or axial view for confirmatory purposes.

[1] Accepted for publication in April, 1939.

Historical.—Posterior dislocation of the head of the humerus is rather uncommon. In a large series of cases, only five have been encountered by us.

According to Malgaigne, the earliest mention of posterior shoulder dislocation was made in 1804, and up to 1855 he could collect only 37 cases, including three of his own. A considerable number have been recorded since then from clinical and autopsy studies but few from the roentgen standpoint.

Blackett and Healy, in 1937, in their paper on roentgen studies of the shoulder from the standpoint of demonstration injury to tendon attachments, suggested four views, one of which was the vertical view.

Thomas, in 1937, made a valuable contribution from the roentgenographic standpoint, emphasizing: the rarity of the con-

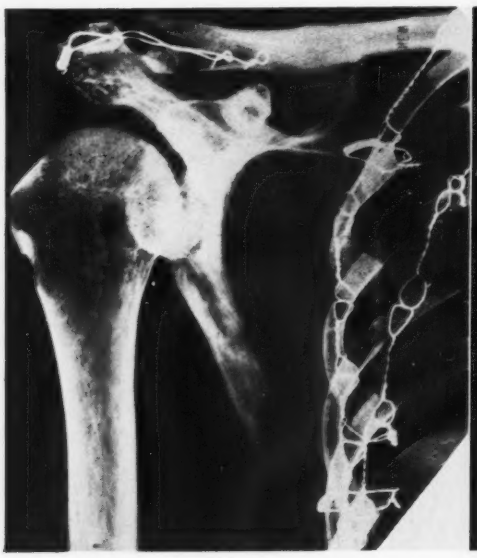

Fig. 1

Fig. 2.

Fig. 1. Anteroposterior view of a normal shoulder of an anatomical specimen.
Fig. 2. Anteroposterior view of a posterior dislocated shoulder of an anatomical specimen.

dition; its frequent association with fractures; its frequent occurrence during epileptic and convulsive seizures, and the formation of accessory glenoid fossæ in the non-reduced cases.

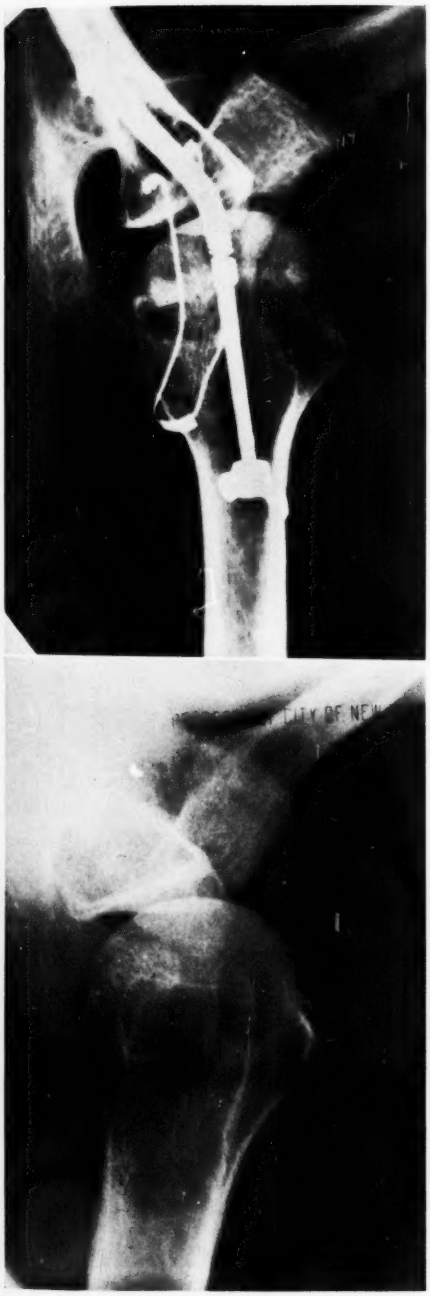

Fig. 3. Axial view of the normal shoulder—*in vivo* (*below*) and in the anatomical specimen (*above*).

Classification.—In posterior dislocation the primary displacement is backward but two sub-divisions are recognized, depending upon the position the humeral head assumes:

Subacromial: in which the head lies under the projecting outer border of the acromion.

Subspinous: in which the head lies further back below the spine of the scapula. This type is most uncommon.

Pathogenesis.—The common mode of production is pressure backward and outward upon the head of the humerus, either directly or through the elbow, combined with adduction of the limb across the front of the chest and internal rotation.

Cadaver experiments indicate that the dislocation can be readily produced by forcible internal rotation of the arm, by which the posterior portion of the capsule is torn and the passage of the head backward and outward is made easy.

In the subacromial variety, the humeral head is found under the acromion looking backward and inward, with its anatomical neck engaged against the posterior edge of the glenoid fossa, and the lesser tuberosity lying on the latter. This type may be transformed into a subspinous one by di-

Fig. 4. Posterior dislocation in the anteroposterior view. Diagnosis difficult but possible by using diagnostic aids described in the text.

minishing the internal rotation sufficiently to free the lesser tuberosity, and then forcing the humerus backward toward the dorsum of the scapula.

Thomas cites the frequent occurrence of the dislocation during epileptic or convulsive seizures both in his series of cases and in others in the literature, which leads him to conclude that spasm is the sole etiology.

From our experience it appears that some trauma is necessary.

Diagnosis.—The simple anteroposterior or postero-anterior views alone may be suggestive in determining the disturbed relationship between the humeral head and the glenoid fossa. Stereoscopic anteroposterior views are really a basic requisite for the proper diagnosis.

The following points, verified by us by many roentgen studies and experiments on the skeleton and in the normal human, together with analysis of our five cases of posterior dislocation, permits the diagnosis on the simple views. As noted on the film, in a posterior dislocation the lesser tuberosity is rotated and brought into extreme profile medially at the posterior lip of the glenoid fossa, thus making it more readily recognizable than normally. The greater tuberosity is not quite so medial as the

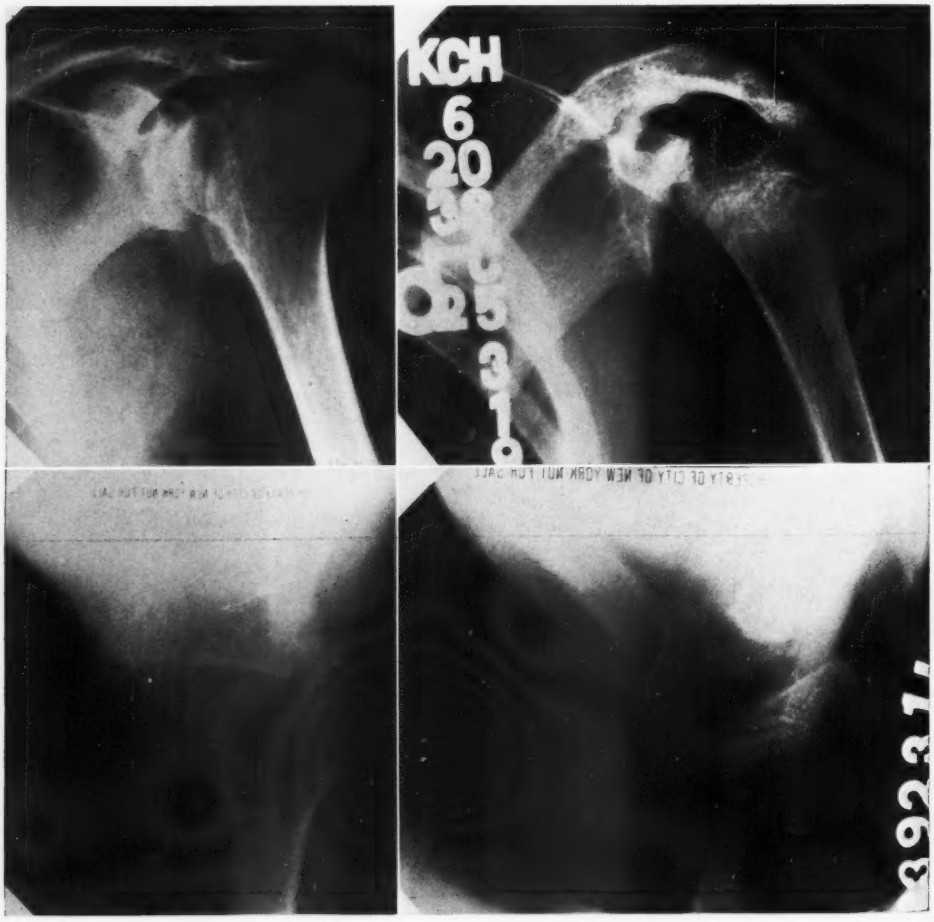

Fig. 5. Fig. 6.

Figs. 5 and 6. Posterior dislocation in the anteroposterior and axial views.

lesser and their shadows overlap, but the latter definitely forms the medial profile. Since this can to some extent be simulated by a marked internal rotation of a normal humerus, we have found it differentially diagnostic to note the position of the articulating surface of the head whenever the lesser tuberosity is so medially placed. With a dislocation, the head is directed posteriorly and medially, while in a markedly rotated normal humerus the head is directed laterally with the greater tuberosity overshadowing the lesser and actually presented in profile medially. This is a very important differential point and is especially demonstrated in well developed individuals with prominent humeral tuberosities.

On the stereoscopic examination, the posterior displaced head in relation to the glenoid fossa is especially well demonstrated.

Another diagnostic aid is the exposure of the lower third of the glenoid fossa in the posterior dislocation due to the displaced head. This feature has been reproduced by us in the normal by taking films with the shoulder and elbow elevated such as happens when the arm is immobilized by the Velpeau bandage, but here the direction of the head and the position of the tuberosities are normal.

For confirmatory purposes, we have made use of the vertical view, using either a supero-inferior projection with a curvex cassette in the axilla or an infero-superior projection with a straight cassette on the shoulder.

This furnishes us with a vertical view which establishes the diagnosis beyond question. Incidentally, this view, as pointed out by others, is also valuable in the demonstration of other pathologic changes in the corocoid and acromial processes.

CONCLUSIONS

Posterior dislocation of the shoulder is very uncommon and difficult to diagnose clinically. It may be diagnosed in the simple or stereoscopic films by the use of the following:

1. Examination made in the usual adduction position without marked internal rotation and without bandages or appliances elevating the shoulder.
2. Humeral head is found to be directed posteriorly and medially.
3. The lesser tuberosity forms the medial border in extreme profile.
4. The lower third of the glenoid fossa is exposed.

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DIAGNOSTIC DIFFICULTIES IN ROENTGEN-RAY EXAMINATION OF PULMONARY TUBERCULOSIS[1]

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ROENTGENOLOGISTS, as a result of experience, have well formed concepts of the roentgen-ray appearance of pulmonary tuberculosis in its varying types and combinations of types. These concepts include characteristics of the shadows and typical locations of the lesions, and are so accurate that the wise pathologist, at the autopsy, will use all the resources at his command before he disputes the diagnosis of the roentgenologist. Pulmonary diseases other than tuberculosis are often equally characteristic in their appearance on the roentgenogram. There are, however, many cases in nearly all diseases of the lungs in which typical roentgenographic findings are lacking and a definite diagnosis cannot be made from a single roentgenogram of the chest. Our mistakes, appreciated and corrected, teach us more than our successes, and each difficult case, finally solved, leads to a better understanding of other diagnostic problems. The more we can share our experiences, the better will be our mutual understanding, the more tolerant we become of the mistakes of others, and the more efficient we become as individuals.

With these ideas in mind, we are presenting a series of cases, each of which, on the basis of a roentgenogram of the chest together with the history and physical findings, was diagnosed pulmonary tuberculosis. In all of these cases, the major illness was subsequently proven to be non-tuberculous. The cardinal symptoms of pulmonary tuberculosis: cough, hemoptysis, thoracic pain, loss of weight, night sweats, and fever were present in varying combinations and in varying degrees in all of these cases and are common to so many pulmonary diseases that they are not, in themselves, diagnostic. Careful attention to details of these symptoms is of great value in arriving at a correct diagnosis.

Cough, when productive of foul sputum, indicates lung abscess or bronchiectasis but, also, occurs in excavating and secondarily infected tuberculosis.

Hemoptysis, while frequent in tuberculosis, may also be present in pulmonary congestion resulting from cardiac lesions and in ulcerated lesions of the bronchial tree, including cancer and bronchiectasis.

Thoracic pain is, usually, less prominent in tuberculosis than in cancer and pneumonia.

Loss of weight is nearly always present in cancer and, usually, present in tuberculosis but may occur in other debilitating and chronic pulmonary diseases.

Night sweats and fever are the least diagnostic of the so-called cardinal symptoms.

History of exposure to tuberculosis, of previous tuberculosis, or the roentgenologic evidence of previous tuberculosis may be either misleading or helpful and must be evaluated with extreme caution.

Sudden onset of a tuberculous infection is much more common than was realized in the pre-roentgen-ray period. We have also learned that non-tuberculous pneumonic consolidations can persist long after the subsidence of acute symptoms.

All of the types of pulmonary disease in which the roentgenogram of the chest may resemble that of tuberculosis have not occurred on the services from which this material is derived. Examples have been selected of diseases producing the most

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diagnostic errors and the most difficult diagnostic problems.

Bronchopneumonia.—Case 10985 (Figs. 1 and 2), white female, six years of age, was hospitalized with a maculopapular rash diagnosed as measles. She had a cough, rapid respirations, a temperature of 104°, and both ears were draining following paracentesis. On physical examination, moist râles were found scattered throughout both lungs. A roentgenogram made on the day of admission showed a miliary-like infiltration of both lungs but without visible lymph node enlargement. A roentgenogram made three weeks later, after the temperature had remained below 100° for a week, showed complete clearing of both lungs.

Bronchopneumonia is, usually, differentiated from tuberculosis by its history of sudden onset, characteristic temperature, and leukocytosis, and by the location of the lesions in the lower lobes.

In children, the consolidation is frequently in an upper lobe and may be in the infraclavicular region, but lesions are rarely multiple and are seldom accompanied by visible lymph node enlargement. If enlarged lymph nodes are visible, they nearly always subside with the clearing of the consolidation.

A type of widely disseminated bronchopneumonia is seen which, in the roentgenogram, so strongly resembles a miliary or hematogenous tuberculosis that a differential diagnosis must be deferred until the progress of the lesions can be determined by a comparison of successive roentgenograms.

Another type of bronchopneumonia has patchy areas of consolidation with sufficient pleural involvement to obliterate the costophrenic angles. If shadows of calcium deposits, residual from previous tuberculous infections, are also present, these cases may so strongly resemble a reactivated tuberculosis that a differential diagnosis depends on sputum examination or on the progress of the lesions in successive roentgenograms. Clearing of the consolidations following the subsidence of symptoms may be so slow, even in adults, that the diagnosis may be deferred for several weeks.

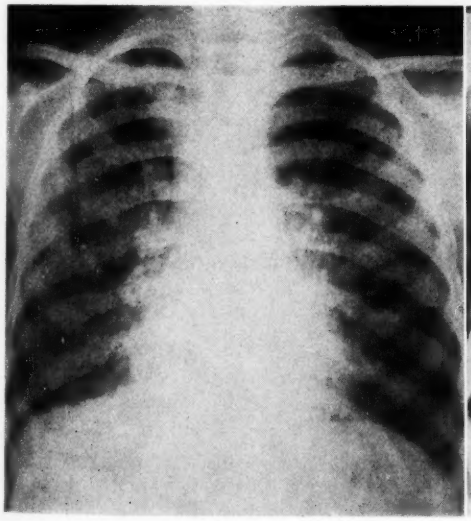

Fig. 1.

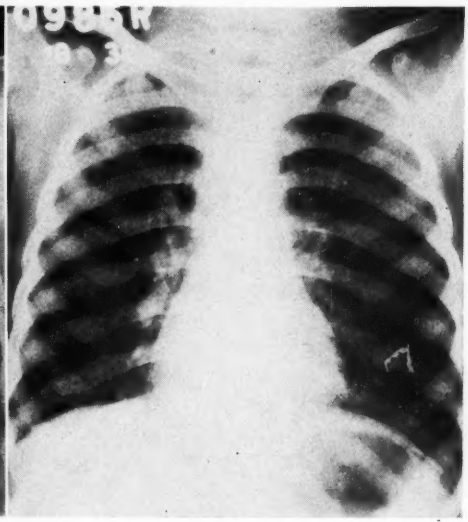

Fig. 2.

Fig. 1. (Case 10985.) March 25, 1938: Miliary-like infiltration of both lungs with calcium deposits above right hilum.

Fig. 2. (Case 10985.) April 19, 1938: Three weeks later. Almost complete clearing of the infiltrations. Repeated sputum examinations showed no acid-fast bacilli. Final diagnosis: bronchopneumonia.

Lung Abscess.—Case 18019 is that of a white male, 45 years of age. Ten years before admission to the hospital, the patient had pneumonia followed by empyema, and a cough had persisted since that illness. Three weeks before admission, he began to have pain in the chest, became progressively weak, found that he had lost weight, and his cough became productive of foul sputum. On physical examination, impaired resonance and fine râles were found over the upper portion of the right side of the thorax. The roentgenogram showed a dense infiltration in the upper half of the right lung with areas of rarefaction suggesting excavations. Repeated sputum examinations failed to show acid-fast bacilli. A bronchoscopic examination showed mucopurulent material in the right middle lobe bronchus. After four weeks of hospitalization, his temperature had subsided, his expectoration had decreased, and a roentgenogram showed such marked clearing that lung abscess was diagnosed and he was discharged from the hospital as non-tuberculous.

Post-pneumonic lung abscesses are usually located in the lower lobes, often in the upper portion of these lobes where they appear, in the roentgenogram, near the hilum of the lung. They may occur in either the apical or basal regions, excavation may be slow, the sputum is not always foul, and the diagnosis may depend on the presence or absence of acid-fast bacilli in the sputum. Roentgenograms of multiple abscesses of hematogenous origin may very closely resemble diffuse exudative tuberculosis with excavations. A differential point which is sometimes present is that, in the non-tuberculous abscesses, the lesions are as a rule larger in the lower lobes while, in tuberculosis, the larger excavations are generally in the upper portions of the lungs.

Bronchiectasis.—Case 13345 was that of a white male patient, 60 years of age, who was hospitalized because of cough producing blood-streaked sputum, dyspnea, thoracic pain, loss of weight and strength, and night sweats. He gave a history of having had pneumonia on the right side and of having had asthma for 13 years. Repeated sputum examinations showed

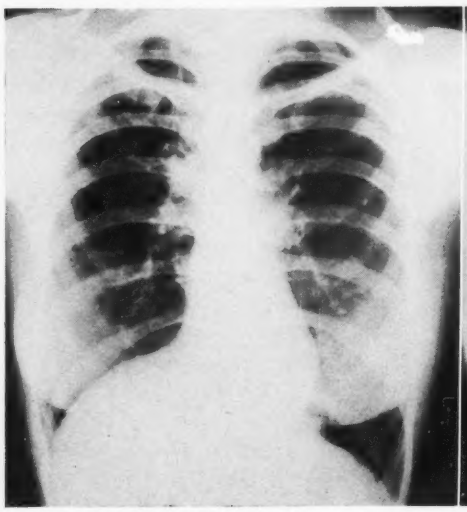

Fig. 3.

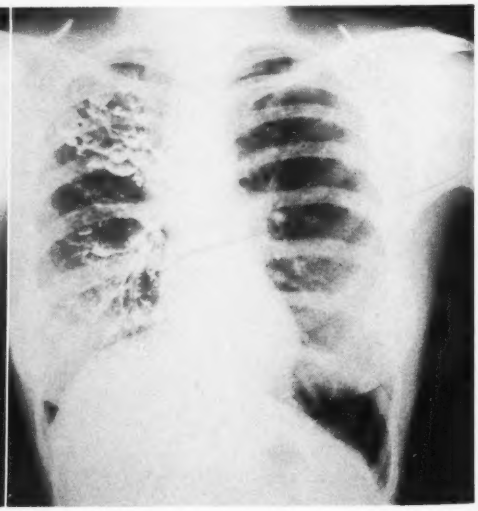

Fig. 4.

Fig. 3. (Case 11936.) Jan. 8, 1935: Fibrosis scattered in upper third of right lung. Hospitalized because of hemoptysis. Repeated sputum examinations failed to show acid-fast bacilli.

Fig. 4. (Case 11936.) Jan. 18, 1935: Lipiodol instillation shows spherical cyst-like cavities of wider distribution than first film indicates.

no acid-fast bacilli. Lipiodol instillation showed bronchiectasis.

The lesions of bronchiectasis are usually in the lower lobes or, when generalized, their greatest density is more frequently seen in the lower lobes than elsewhere. During periods of remission of symptoms, the roentgenograms may fail to show any abnormality. The instillation of lipiodol is the most valuable diagnostic aid in bronchiectasis. While the procedure is ordinarily harmless, it may be followed by perifocal irritative reaction which, in the roentgenogram, may strongly resemble miliary tuberculosis or an acute extension of tuberculous infection such as is seen after pulmonary hemorrhage. When such conditions are present, roentgenograms and sputum examinations should be repeated.

Bronchiectasis has been demonstrated by lipiodol instillation and found, at autopsy, in cases of active tuberculosis and in lungs containing the residual scars of tuberculous infection.

Pulmonary Cystic Disease.—Case 11936 (Figs. 3 and 4). The patient, a white female, 22 years old, had pneumonia at the age of five months and about twelve times subsequently. At the age of five years, she had severe pulmonary hemorrhages during pneumonia. When eight years of age, the patient was hospitalized for two years with a diagnosis of first infection type of pulmonary tuberculosis. At the age of 16, she was again hospitalized as tuberculous because of the appearance of the roentgenograms of her chest and the presence of persistent productive cough with blood-streaked sputum with a history of loss of strength, chills, fever, night sweats, and thoracic pain. Three months before the present admission to the hospital, she had an hemoptysis of about thirty c.c. and, five days before admission, she had a pulmonary hemorrhage of about five hundred c.c., followed by five hemorrhages in the next two days. Repeated sputum examinations failed to show acid-fast bacilli. Lipiodol instillation showed multiple, rounded, cyst-like lesions extending into the outer zones of the lung. Her symptoms subsided and she was discharged as having a non-tuberculous cystic disease.

Cases of pulmonary cystic disease frequently give a history of periods of productive cough with blood-streaked sputum and many of them have been hospitalized as tuberculous but the diagnosis was not confirmed. Roentgenograms of the chest strongly resemble those of productive tuberculosis but lipiodol instillation provides the basis for differential diagnosis.

Primary Cancer of the Lungs.—Case 17569 was a 66-year-old colored male (Figs. 5 and 6). Three years before admission to the hospital, he had developed a persistent cough which was not relieved by medication. Six months before admission, pain in the chest and dyspnea began and increased. The cough became productive and loss of weight and strength became marked. He was transferred from another hospital to the tuberculosis service with a diagnosis of pleurisy with effusion. The physical examination showed emaciation and signs of fluid in the right side of the chest. A roentgenogram of the chest showed atelectasis of the right lower lobe and pleurisy with effusion. On aspiration of the chest, clear, straw-colored fluid was obtained. No acid-fast bacilli or other organisms were found in it by either direct smears or cultures. Repeated sputum examinations showed no acid-fast bacilli. The patient was considered too ill for bronchoscopy and expired three months after admission to the hospital.

Autopsy revealed a primary bronchiogenic carcinoma obstructing the bronchi and pulmonary veins of the right lower lobe, infiltrating the mediastinum and the heart with partial obstruction of the superior vena cava, the tricuspid valve, and the esophagus. A fibrous inactive tuberculous lesion in the right upper lobe and calcified peribronchial lymph nodes were also present.

The presence of inactive tuberculous lesions in cases of pulmonary cancer is not infrequent and rapidly progressive exuda-

tive tuberculosis in a lung impaired by bronchiogenic carcinoma has been observed, so neither of these diseases excludes the other. Thoracic pain and loss of weight are more prominent in the symptomatology of pulmonary cancer than in pulmonary tuberculosis. Primary carcinoma of the lung usually begins in the bronchial mucosa and early in its development the lesion frequently produces bronchial obstruction and atelectasis. This course of events has repeatedly aided the roentgenographic interpretation. When the primary cancer ulcerates, it may produce an abscess which in the roentgenogram may strongly resemble an abscess due to pyogenic infection or a tuberculous excavation.

Metastatic Cancer.—Case 15948 (Figs. 7 and 8). Six weeks before hospitalization, the patient, a 29-year-old white male, had a moderately severe, acute respiratory infection, followed by persistent and increasing cough which became more and more productive and was accompanied by dyspnea which increased rapidly and became severe. No abnormal findings were detected on physical examination. There was no temperature elevation. A blood count, on admission, showed 20,000 leukocytes and, two weeks later, 28,000 leukocytes. Repeated sputum examinations showed no acid-fast bacilli, yeasts, or fungi. A roentgenogram showed a miliary-like infiltration throughout both lungs and, when repeated three weeks later, a marked increase in density of the infiltrations. The dyspnea increased and the patient expired one month after admission to the hospital.

At autopsy, the lungs were found to have the gross appearance of diffuse fibrosis without definite characteristics of etiology. Microscopic examination of sections revealed a metastatic carcinoma infiltrating the lymph channels. The primary carcinoma was found in the adrenal cortex.

Metastatic pulmonary cancer may be of a small nodular type strongly resembling miliary tuberculosis, or pleural metastases

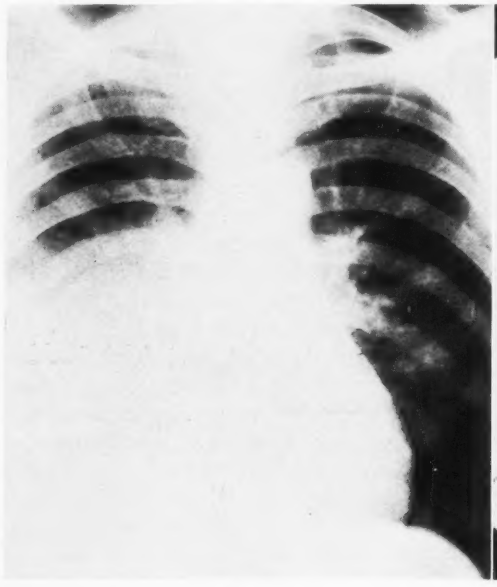

Fig. 5.

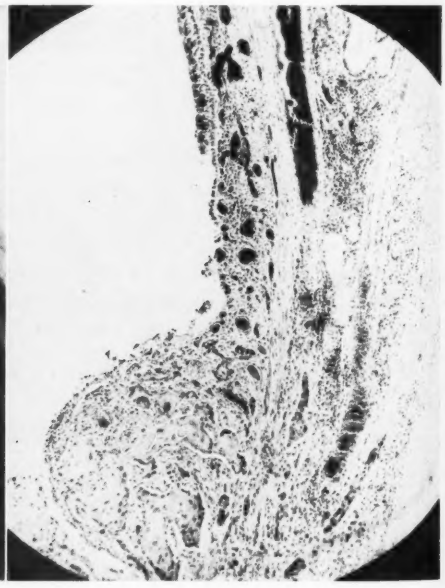

Fig. 6.

Fig. 5. (Case 17569.) May 17, 1937: Increased density on the right, indicating pleurisy with effusion. Deviation of trachea suggests atelectasis.

Fig. 6. (Case 17569.) Aug. 10, 1937: Autopsy showed bronchiogenic carcinoma of squamous-cell type, infiltrating mediastinum and myocardium.

may give rise to a pleural effusion, masking the roentgenogram.

Silicosis.—Case A-2201 was a white male, 60 years of age, who was seen in the Out-patient Department because of thoracic pain and productive cough of four months' duration. Repeated sputum examinations showed no acid-fast bacilli. He had worked as a coal miner and the roentgenogram was interpreted as silicosis. He has been under observation for five years and repeated roentgenograms show no essential difference in appearance.

Silicosis has tuberculosis so frequently superimposed that the roentgenographic appearance of silicosis should always carry the suggestion of tuberculosis. An accurate diagnosis is important, for the silicotic may not need hospitalization and the method of management of the tuberculosis depends on whether or not silicosis is associated with it. The dangers of collapse therapy in tuberculosis accompanied by silicosis have been learned by experience.

The early lesions of silicosis may have a roentgenographic resemblance to productive tuberculosis but the silicotic lesions are more diffuse and cover larger areas than the productive tuberculous lesions which they resemble.

The second degree of silicosis may have a striking roentgenographic resemblance to miliary tuberculosis but a history of exposure to silica and the presence or absence of symptoms of miliary tuberculosis are of assistance in making the correct diagnosis. The submiliary tuberculosis of hematogenous distribution may produce a roentgenographic appearance entirely out of proportion to the symptomatology. In these cases, if a history of exposure is obtained and acid-fast bacilli are not found in the sputum, it may be impossible to make a diagnosis from a single roentgenogram. A comparison of successive roentgenograms taken at intervals will show progress of the tuberculous lesions of this type, either clearing or increasing, while the appearance of the silicotic lesions will show relatively little change.

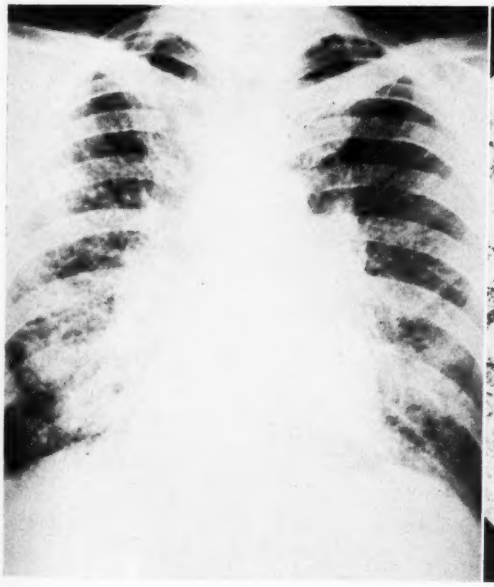

Fig. 7.

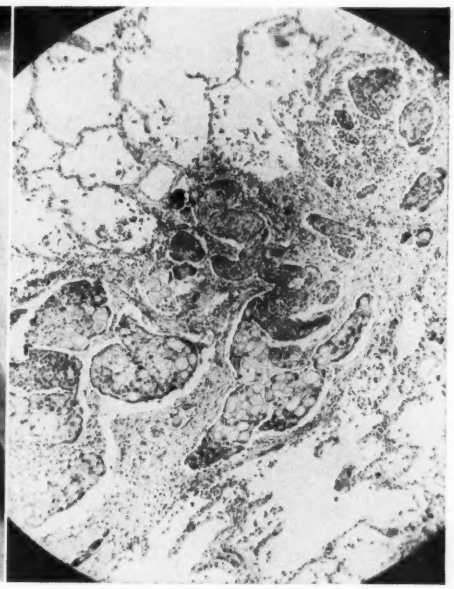

Fig. 8.

Fig. 7. (Case 15948.) Jan. 11, 1936: Miliary-like mottling throughout both lungs. Repeated sputum examinations showed no acid-fast bacilli, yeasts, or fungi.

Fig. 8. (Case 15948.) Feb. 6, 1936: Autopsy showed metastatic carcinoma of foam-cell type in lymph channels. Primary carcinoma of adrenal.

In the third stage of silicosis, the symptoms and clinical findings may not be greatly altered if tuberculosis is superimposed. The roentgenograms show fairly well defined, dense shadows on a finely mottled background. The differentiation from tuberculosis without silicosis is usually not difficult but, when tuberculosis is superimposed on a third degree silicosis, there may be little change in the roentgenograms and the clinical findings may not be greatly altered. Rapidly enlarging cavities indicate active tuberculosis but a definite diagnosis may depend on the finding of acid-fast bacilli in the sputum.

Cardiac Disease.—Case 10725 (Figs. 9 and 10). A white female, 21 years of age, was under observation for two years as a tuberculosis suspect because of a persistent cough and roentgenograms showing increased lung markings. Two years before admission to the hospital, she developed an empyema from which she recovered following operation, but productive cough persisted and her sputum was occasionally blood-streaked. She became dyspneic, lost weight and strength, her ankles swelled, and she developed ascites. Electrocardiograms showed myocardial damage. During periods of cardiac decompensation, roentgenograms of the chest showed infiltrations which decreased with improvement of her cardiac condition. Repeated sputum examinations failed to show acid-fast bacilli.

Pulmonary congestion due to cardiac disease produces roentgenographic shadows which are, for the most part, in the middle and basal portions of the lungs and bilaterally symmetrical. Occasionally, the lesions are not uniformly distributed and they may be in the upper or infraclavicular regions. Chronic valvular heart disease may produce pulmonary fibrosis which strongly resembles productive tuberculosis in the roentgenogram. The differential diagnosis is made more difficult by hemoptysis which is common in these cases.

Uncommon Inflammatory Diseases of the Lung (Pulmonary Moniliasis).—Case A-67497, a 69-year-old white male, had had, for a year before admission, progressive fatiguability, productive cough, dyspnea, and substernal pain and had lost about twenty pounds of weight. Repeated sputum examinations showed no acid-fast bacilli.

At autopsy, a diffuse fibrosis was found

Fig. 9.

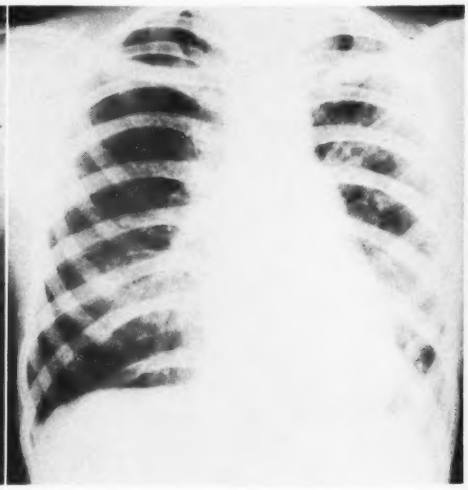

Fig. 10.

Fig. 9. (Case 10725.) Oct. 6, 1933: Marked increase in density in both lungs with definite cardiac enlargement.

Fig. 10. (Case 10725.) Nov. 22, 1933: Six weeks later. Heart smaller, pulmonary congestion has markedly decreased.

and *Monilia* with mycelia were identified in stained sections of the lung and isolated in cultures from lung tissue.

The roentgenographic shadows produced by actinomycosis, blastomycosis, and moniliasis are those of diffuse fibrosis,

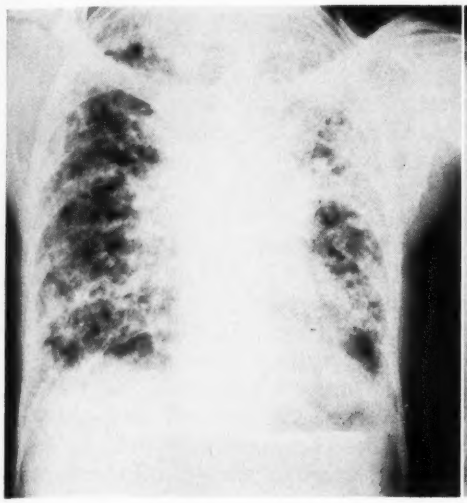

Fig. 11.

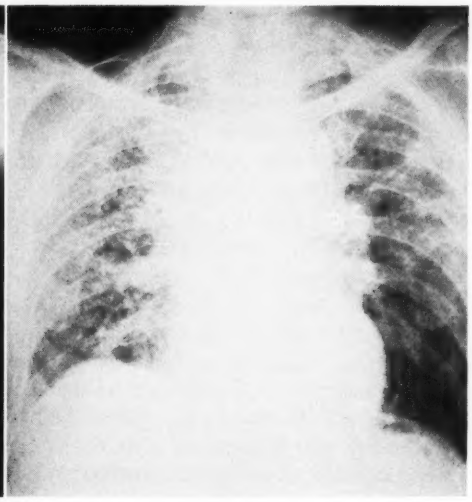

Fig. 12.

Fig. 11. (Case 17489.) April 22, 1937: Diffuse infiltration of both lungs. Repeated sputum examinations failed to show acid-fast bacilli. Autopsy showed non-tuberculous chronic fibrosing pneumonitis.
Fig. 12. (Case 67597.) March 15, 1935: Diffuse miliary-like infiltrations of both lungs with shadows suggesting lymph node enlargements. Repeated sputum examinations showed no acid-fast bacilli. Sputum cultures showed *Monilia* with mycelia. *Monilia* stained in sections of lung obtained at autopsy April 22, 1935.

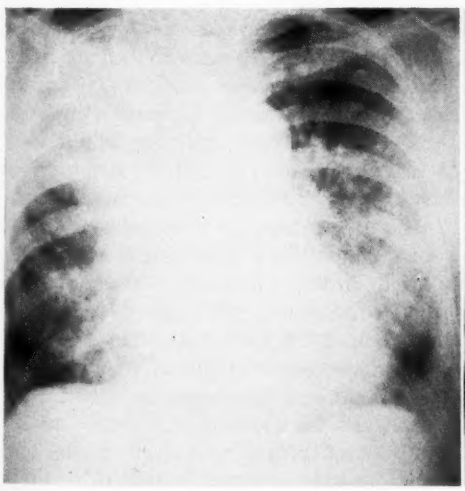

Fig. 13.

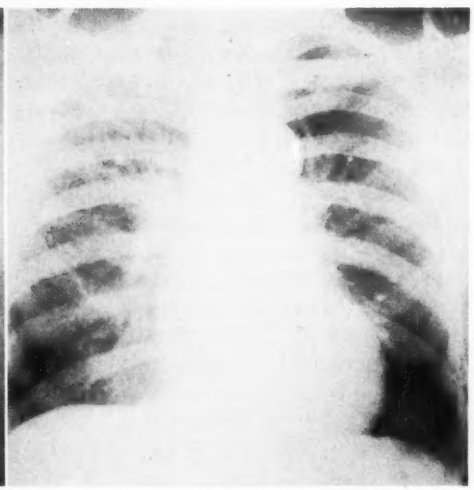

Fig. 14.

Fig. 13. (Case 11299.) Nov. 19, 1931: Opacity of consolidation in upper right lung with mottling in middle and basal portions of both lungs. Repeated sputum examinations failed to show acid-fast bacilli. Serological tests for syphilis positive.
Fig. 14. (Case 11299.) Dec. 22, 1931: Almost complete clearing of former opacities following antisyphilitic therapy.

often with small abscesses. They may suggest some unusual condition but are rarely diagnostic and may be indistinguishable from the bizarre distributions of fibrosis sometimes present in productive tuberculosis.

Syphilis of the Lung.—Case 11299 (Figs. 13 and 14). A colored male patient, 40 years of age, began to lose weight and strength six months before admission to the hospital. Four weeks before admission, he developed a severe cold with chills, fever, and night sweats. A roentgenogram of the chest was made and hospitalization was advised. Repeated sputum examinations failed to show acid-fast bacilli. On serological examination of the blood, a strongly positive test indicative of syphilis was found. Under anti-syphilitic therapy, the symptoms subsided and roentgenograms taken at intervals showed progressive clearing of the infiltrations.

The rarity of this condition is indicated by the finding of only two cases in the examination of roentgenograms of the chest of about four hundred and forty thousand individuals.

SUMMARY

Cases of pulmonary diseases are presented in which the shadows seen in the roentgenograms of the chest were interpreted as being due to pulmonary tuberculosis. All these cases were eventually proven to be non-tuberculous.

A discussion of diagnostic difficulties and methods useful in differential diagnosis is offered.

A roentgenogram of the chest may be diagnostic: there are many cases in which it is only one of the examinations which must be employed in making a diagnosis.

DISCUSSION

BRUCE DOUGLAS, M.D. (Detroit, Mich.): In these days of extensive x-ray surveys of large numbers of persons in various groups, the roentgenologist is called upon to deal with the diagnosis of many conditions with only the film available. Therefore, it is necessary, in many instances, to add to his information further valuable facts from the history and his studies before making a diagnosis. As Dr. Birkelo has so convincingly shown us, there are many conditions that may be seen on the x-ray film which would suggest tuberculosis strongly, and yet, when finally analyzed, are found to be due to any one of a number of other diseases.

However, this does not detract in the least, in my opinion, from the value of making extensive surveys with the x-ray film for the purpose of uncovering just such problems as this. The physician who works with the roentgenologist in attempting to evaluate the findings in such surveys is in a position to assist the roentgenologist materially, as the roentgenologist is to assist him, and here there is room for close co-operation in asking for those additional procedures that will help clinch the diagnosis.

It is often easy for the roentgenologist to see the film, suspect tuberculosis—yet entertaining a possible suspicion that it is something else—and ask for a whole host of other types of examination which it is not always possible to carry out.

One of the most frequent requests that should go with suspicion of tuberculosis is for the analysis of the sputum—the search for tubercle bacilli. Too often we are content with the statement from some source that there are no tubercle bacilli in the sputum of the patient and not go back of that statement to determine just how carefully the sputum was examined. If we are going to depend on a negative sputum as a definite criterion for a diagnosis other than tuberculosis, we must be sure that it has been examined not just once but a number of times and by careful methods.

It has been surprising, in one of our institutions in Detroit, to note the large number of individuals that can be found with positive sputum, with lesions that at first will be thought to be inactive or otherwise non-productive of bacilli. By taking a seven-day pooled specimen—that is, by collecting all the sputum that may accumulate over that period of days—and

then, by making an examination by concentration methods, it is possible to find acid-fast bacilli more frequently than by the ordinary methods.

The result of making mistakes, such as Dr. Birkelo has pointed out, is indeed a valuable experience, if we are in a position to use the other aids that may be brought into the picture for the purpose of clinching the diagnosis in favor of some other condition.

Lipiodol—as Dr. Birkelo indicated and I wish to confirm—can be used in tuberculosis without fearing any harm. There is one word of caution I would like to say in the use of lipiodol in a diagnostic problem involving tuberculosis—that most of the other procedures to be employed in the diagnostic field in a given case ought to be completed before one instills the opaque oil. This is for the simple reason that, having once put it in, it remains in the lung for some time and confuses the picture, making it difficult to get satisfactory roentgenograms for a period thereafter.

Bronchoscopic examination is helpful in many of these cases and ought to be done in most instances in which there is a questionable diagnosis before the lipiodol is put in. In our experience at least, lipiodol instilled by the supraglottic method without the bronchoscope is preferable to lipiodol put in with it. When put in with the bronchoscope, it is apt to fill the alveoli so thoroughly that it does not give a satisfactory bronchogram.

As regards the case of syphilis presented, it always leaves an unsatisfactory feeling in our minds when the diagnosis is made on a therapeutic test, but as you all know, that is about the only evidence we have to support the diagnosis of syphilis of the lung. I think Dr. Birkelo is right in this case, but we all have to grant that it is a rare condition. About the only evidence we have for the support is the fact that we are able to clear it up promptly with antisyphilitic therapy.

I want to thank Dr. Birkelo for presenting these cases that should be instructive to all of us, for not just making the diagnosis of tuberculosis and letting it go at that, but for following through with the co-operation of the internist and others involved, and in establishing definitely the diagnosis in questionable cases.

LEO G. RIGLER, M.D. (Minneapolis, Minn.): I was much interested in the first case which Dr. Birkelo showed because of some recent investigations of that type of lesion. You will remember he showed a case of what we have commonly called capillary pneumonia or bronchiolitis, which is not an uncommon complication of measles, and he said this might be measles of the lungs. In fact, that is probably true.

This type of pneumonia is due to the virus of measles and recently Reimann, at Jefferson Medical College, has described a virus causing this type of pneumonia without measles preceding it. We see it every once in a while, and, as Dr. Birkelo pointed out, a differentiation from acute miliary tuberculosis may be quite difficult.

We have found that there are two points helpful in making that differentiation: First, the lesions, as shown in this particular case, are distinctly coarser, larger, and less homogeneously distributed than the ordinary case of acute miliary tuberculosis; and second, the roentgenologic findings appear very quickly after the onset of the lesion within, let us say, 24 hours after the patient develops the characteristic high temperature, cyanosis, etc., which is certainly not true in acute miliary tuberculosis, in which usually an interval of time—perhaps a week or two—must elapse after the onset of the symptoms before distinct roentgenologic findings are apparent.

L. H. GARLAND, M.D. (San Francisco): In addition to the lesions mentioned by Dr. Birkelo, one must consider two additional pathologic conditions in the differential diagnosis of pulmonary tuberculosis from the roentgenogram alone. These

are: coccidioidal granuloma and *Streptothrix* infection. It has been shown in recent years, chiefly by Dickson and his fellow workers, that coccidiodal infections of the lung are not uncommon and that, with increasing migration of casual workers to and from the San Joaquin Valley district, cases of pulmonary infection with this organism are appearing in most parts of the United States. As you are all aware, coccidioidal granuloma is frequently a relatively benign infection which may clear up just like a benign pulmonary tuberculous infection. Only the more advanced and chronic cases show the dramatic osseous lesions and extensive pulmonary lesions which we learned in medical school some years ago.

Streptothrix infections of the lungs are often not associated with much fibrosis and may perfectly mimic an upper lobe pulmonary tuberculosis in unilateral and lobar infections. Personally, it has been my feeling for some years that the diagnosis of pulmonary tuberculosis is a bacteriologic or histologic diagnosis, not a roentgenologic one. The roentgenogram shows the extent of the inflammatory changes in the lung, but not the bacterial origin of those changes. By all means, indicate in your conclusion, if you so wish, "pulmonary disease, presumably active, and probably tuberculous," but do not make a positive diagnosis of pulmonary tuberculosis from the roentgenogram alone in the individual person.

CARL C. BIRKELO, M.D. (*closing*): I would like to thank the discussants for the ideas they brought out, and especially Dr. Douglas, because each time he discusses anything, I think it is often better than the original.

I would like to say in regard to Dr. Garland's remark, that I have seen one case of coccidioidal granuloma but it was not one of my own, so I did not have any films on it. We thought this case of coccidioidal granuloma was tuberculosis, and even advised pneumothorax, which was started.

Regarding the pessimistic view that we should leave the diagnoses of tuberculosis to the pathologist and bacteriologist, I cannot agree. We do feel so certain about most tuberculous lesions that we do not hesitate to begin collapse therapy whenever indicated, even if sputum is negative.

THE IMPORTANCE OF BIOPSY IN TUMOR DIAGNOSIS[1]

A REPORT OF EXPERIENCE WITH A NEW BIOPSY NEEDLE

By JOSEPH TENOPYR, M.D., F.A.C.S., *and* IRVING SILVERMAN, M.D.,
Brooklyn, New York

IN the differential diagnosis of tumors, experience has shown how little one can depend on purely clinical methods for accuracy. Transillumination, x-ray examination, or x-ray in combination with the injection of radiopaque substances or air have been discussed in the past, particularly in connection with the diagnosis of breast tumors. In the final analysis, however, we must turn to the pathologist, for his corroborative evidence is by far the most important. How to obtain this evidence with the least danger to the patient is the problem.

Of the methods in use, we have the frozen-section biopsy, various types of punch biopsy, and aspiration biopsy. Without going into a discussion of the merits of each one at the present time, it will be conceded that, until now, the aspiration biopsy has been the simplest and least traumatizing. Its general acceptance, however, has been hampered considerably by the fact that, save in the hands of a very few, it has failed to yield material for a positive diagnosis with sufficient regularity. And, second, even in successful cases the material obtained is so scanty that pathologists have often been unwilling to make a positive statement one way or the other.

It was because of these difficulties that interest was aroused in trying to improve the efficiency of the aspiration biopsy without increasing the amount of trauma. For the past year we have been using a biopsy needle, devised by one of the writers (I. S.), at the Caledonian Hospital, Brooklyn, which consists of two parts. One is an ordinary outer needle of 14 gauge, and the other an inner needle of 17 gauge which is fitted loosely, is split longitudinally in half, and protrudes for half an inch beyond the point of the outer needle (Fig. 1). This instrument differs slightly in size from the one described in the original article.[2] With this biopsy needle it has been possible to obtain a specimen with uniformity and of sufficient size for routine microscopic sections. The results have been so enthusiastically acclaimed by those who have seen this needle used that it was deemed advisable to report some of our more recent ex-

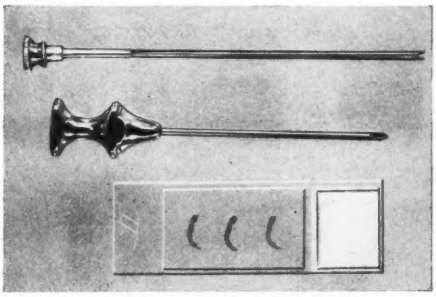

Fig. 1. The biopsy needle with a slide showing the size of the specimen obtained. Slightly reduced.

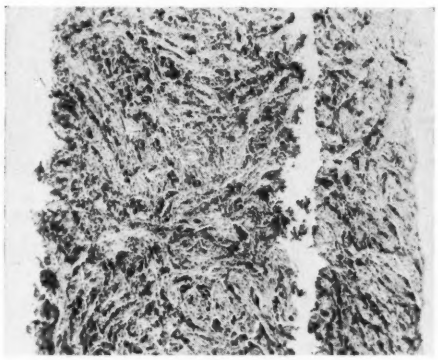

Fig. 2. Paget's disease of the breast. Low power.

[1] Accepted for publication in March, 1939.

[2] SILVERMAN, I.: A New Biopsy Needle. Am. Jour. Surg., **40**, 671, 672, June, 1938.

periences, to show photomicrographs of some of the sections obtained, and to evaluate more clearly the place of needle biopsy in the diagnosis of tumors.

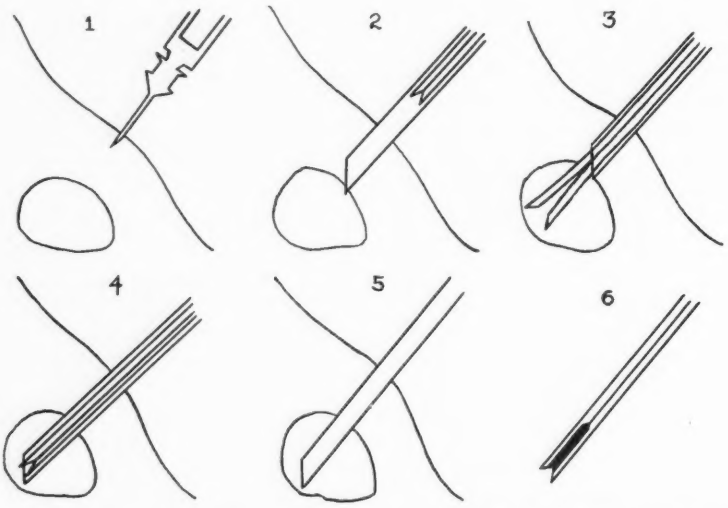

Fig. 3. The technic for obtaining specimen. (1) The skin is anesthetized and then pierced with sharp pointed scalpel. (2) Outer needle is inserted up to the tumor. (3) The inner needle is inserted into the tumor. (4) Outer needle is advanced into the tumor. (5) Inner needle is withdrawn alone or together with the outer needle. (6) Specimen rests in the prongs of the inner needle.

A great variety of neoplasms have been subjected to biopsy, including tumors of the breast, neck, lymph nodes, retroperitoneal growths, abdominal masses, liver metastases, and lung tumors. The last three regions were approached with greatest care and no difficulties were encountered either during or after the procedure. In the case of the lung tumors, it was found advisable to use the fluoroscope to help locate the area desired.

Figure 1 shows the appearance of the biopsy needle[3] in use at the present time, with a photograph of the size of the specimen which is usually removed. A single manipulation is sufficient to obtain tissue, but when the specimen is scanty, it is advisable to insert the inner needle a second time, leaving the outer needle *in situ*. There have been no failures to obtain tissue in any case. The only failures have been the occasional instances in which the tumor was missed by the operator.

Figures 2, 4, 5, and 6 show photomicrographs of some of the sections made from the various specimens.

The technic is extremely simple and is associated with a minimum of trauma. The skin over the site of the suspected mass is prepared in the usual manner. A small intradermal wheal is raised at the site of puncture with 0.5 per cent procaine hydrochloride and about 1 c.c. is injected subcutaneously. The skin is pierced with a sharp pointed scalpel to preserve the sharpness of the outer needle and also to avoid the possibility of carrying a bit of epidermal tissue into its lumen (Fig. 3-1). The tumor mass is grasped between the thumb and forefinger of the left hand, and, with the inner needle in place two-thirds of its length, the outer needle is grasped by the thumb and forefinger of the right hand. The outer needle is then passed through the skin up to the surface of the suspected mass (Fig. 3-2). The inner needle is then

[3] Vim-Silverman Biopsy Needle, made by MacGregor Instrument Co., Needham, Mass.

advanced into the mass (Fig. 3-3). The bevel of the split inner needle is so made that the resistance of the mass causes the two prongs to diverge as they advance into the tumor. The outer needle is then advanced into the tumor, causing the two halves of the split needle to be compressed and severing the attachment of the enclosed specimen from the surrounding tissue (Fig. 3-4). When the outside needle has completely covered the points of the inner needle, both are removed together. The inner needle is then withdrawn with the specimen (Figs. 3-5,6). Quite frequently the specimen cut is so large that it is impossible to advance the outer needle over the inner one, in which event, as soon as both needles are fitting tightly, they are withdrawn simultaneously. One must never rotate the inner needle in the lumen of the outer needle as this will not only lose the specimen but will twist the prongs and render the instrument useless. The report on these specimens can be available in from 24 to 48 hours.

The value of a biopsy is greatest when it is positive. A biopsy specimen which is negative for cancer does not always mean that there is no cancer present: the specimen may have been taken from a fibrotic, cystic, or other area and the neoplasm missed. Second, in those borderline cases in which a diagnosis is difficult at best, the small amount of tissue may be insufficient for a positive diagnosis. So far we have encountered no evidence to show that the insertion of a needle into a malignant growth has been in any way detrimental to the patient. Nor have we heard a contrary opinion from those who have practised aspiration biopsy in the past and with whom this subject has been discussed. All this, of course, presupposes that proper measures were promptly instituted as soon as the diagnosis of cancer was made. Indiscriminate needle puncture of tumors is a procedure which should rightfully be condemned.

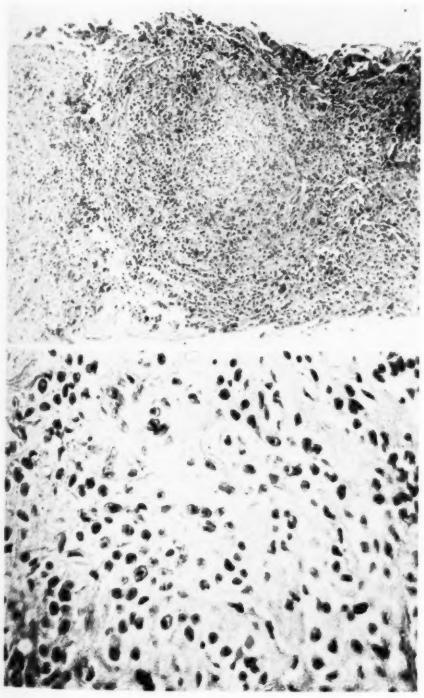

Fig. 4 (*above*). Squamous-cell epithelioma. Low power.

Fig. 5 (*below*). Squamous-cell epithelioma. High power showing mitotic figures and cellular structure.

Fig. 6. Effect of radiation therapy on breast carcinoma. Note the almost complete absence of cellular elements.

The following are some of the indications for needle biopsy.

1. In cases in which pre-operative radiation therapy is indicated, a biopsy is imperative in order to establish not only the diagnosis, but also the type of cancer, since the dosage to be given will differ according to the type tumor to be radiated. Lymphosarcoma and Hodgkin's disease require comparatively small dosages, while adenocarcinoma and epithelioma require much larger dosages. Without a confirmatory biopsy, an excellent post-radiation result always brings up the question of whether or not the tumor treated was benign.

2. In traumatic fat necrosis the clinical resemblance to cancer is so great that only a biopsy will help to differentiate it.

3. In enlargement of the liver a differential diagnosis from cirrhosis is important for prognosis as well as for therapy.

4. In lung tumors in which interpretation of the roentgenograms is difficult or doubtful, there is no better way to establish the diagnosis.

5. Also, in bone tumors in which the same difficulties are often encountered with the interpretation of the x-ray findings, a biopsy may be of great value.

It is suggested that the term "needle biopsy" be used to differentiate this type of biopsy from aspiration biopsy and also from punch biopsy, for, while this instrument resembles a punch, it is actually a modified needle which does not require the use of suction or aspiration.

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LEFT SUBPHRENIC ABSCESS[1]

By HARRY GOLDING, M.D., Roentgenologist, *and* A. J. DELARIO, M.D., Associate Roentgenologist, Department of Radiology, St. Joseph Hospital, *Paterson, New Jersey*

DIAGNOSIS of right subphrenic abscess is relatively easy, particularly when gas is present with the abscess. Left subphrenic abscess, however, is harder to diagnose, first, because it occurs much more infrequently, and, therefore, is not readily thought of, and second, because gas which is normally present in the stomach and colon may mask the gas in the abscess.

It may not be an easy matter to determine that the gas seen in the left subphrenic abscess is not really part of the gastric bubble. It might be possible to label a normal stomach having a high fluid level with a large gas bubble in the fundus as a subphrenic abscess. As roentgenograms are taken of the body in various positions, the air will assume about the same location in reference to the fluid in both the fundus of the stomach and in the abscess.

However, there are certain facts which help to differentiate a stomach filled with air and gas from an abnormal cavity filled with air and gas, such as a subphrenic abscess. Clinically, a patient with a subphrenic abscess, if the abscess is due to a perforation from a peptic ulcer, which is usually the case, will give a history of symptoms and signs of a perforation, and might also give a history of a peptic ulcer in the past. A patient with no pathology in the subphrenic area would probably give a different set of symptoms and signs, depending upon the cause of his illness.

In the second place, cases of subphrenic abscess have a high or elevated diaphragm. There is fixation of the diaphragm on respiration. The diaphragm is two or three times its normal size, and often there is more or less fluid in the pleural cavity above it. A normal stomach with a large *magenblase* (air bubble in the fundus) would cause an elevation of the diaphragm. However, although the mobility of the diaphragm might be decreased, it would not be fixed. The diaphragm would be normal, or diminished in size, but not thickened, and, finally, there would not be any disease in the chest above it.

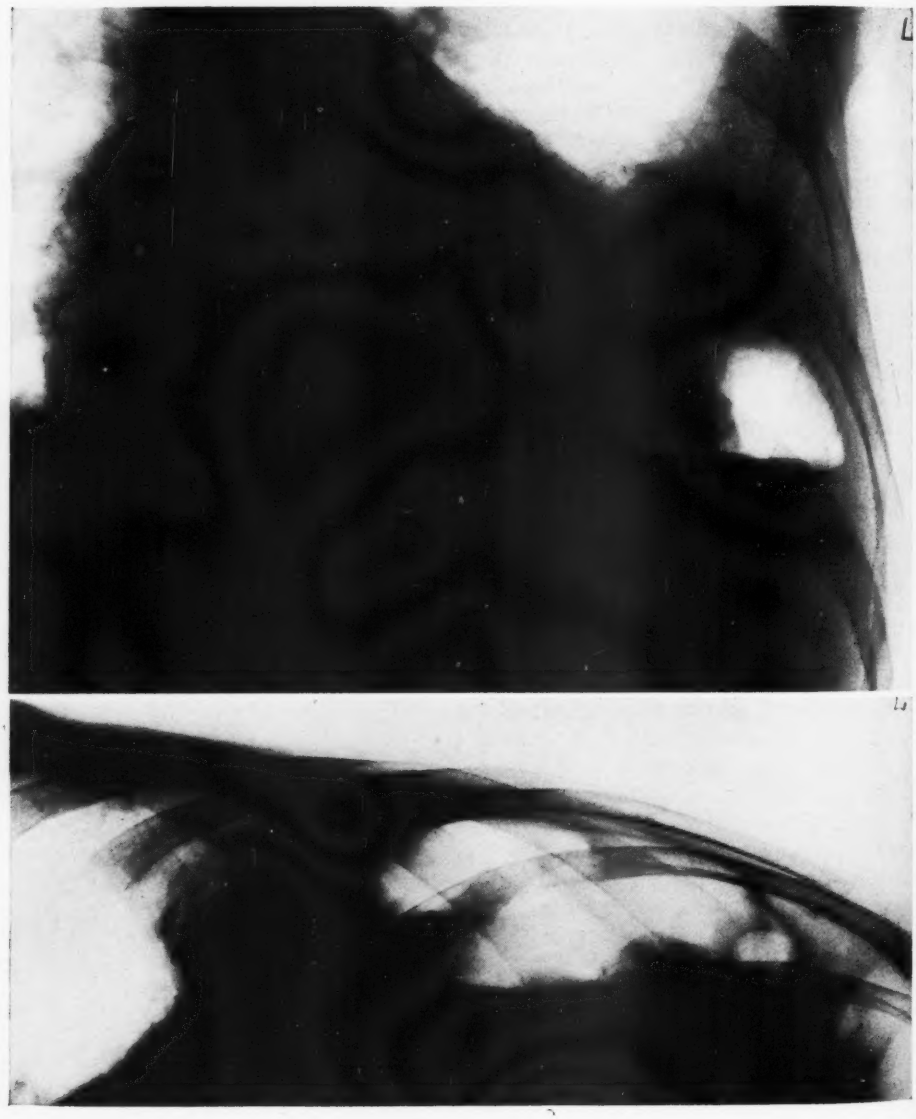
The presence of fluid in the chest as a result of heart disease or some pulmonary condition in a patient with a normal magenblase would obscure the height of the diaphragm and the thickness of the pleura, and the diaphragm would not move on respiration. In such a case the greatest care must be taken lest a mistaken diagnosis of subphrenic abscess be made. Also, the presence of a quantity of fluid in the left thoracic cavity in a case of left subphrenic abscess might, by obscuring the diaphragm and its movements, draw at-

Fig. 1. Case 1. Subphrenic abscess. An anteroposterior roentgenogram taken with the patient lying on his back, with the hips slightly elevated. Notice that the barium in the stomach did not reach the left diaphragm. This shows that something existed between the stomach wall and the diaphragm. There were numerous blood clots in the stomach so that many less dense shadows could be seen throughout the barium.

[1] Accepted for publication in November, 1939.

tention away from the subphrenic area and cause a subphrenic abscess to be missed.

Furthermore, careful observation will show that the gas in a subphrenic abscess is void of structure and is slightly darker

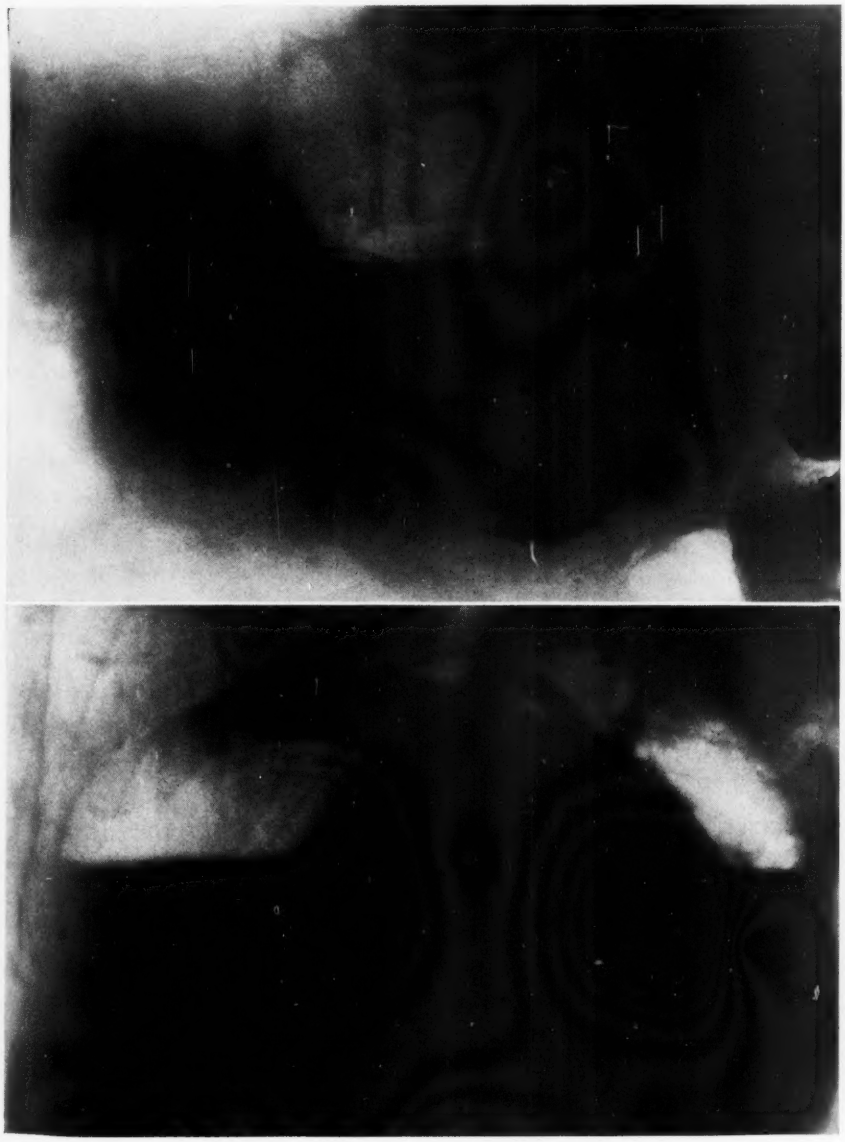


Figs. 2 and 3.

Fig. 2 (*above*). Case 1. Subphrenic abscess. A postero-anterior roentgenogram, taken in the erect position, shows an elevation of the left diaphragm with much gas beneath it. The outer portion of the gas bubble is devoid of structure, a situation as seen in pneumothorax and pneumoperitoneum. The left diaphragm is thickened, there being an area of increased density just above it which is due, in part, to lung compression and in part to pleural fluid, as the infection travels upward through the diaphragm to involve the pleural cavity. Fluoroscopic examination shows no motion of the left diaphragm on respiration.

Fig. 3 (*below*). Case 1. Subphrenic abscess. A postero-anterior roentgenogram, taken with the patient lying on his right side, in which the topmost portion of the gas bubble seems to be devoid of structure.

than the gas bubble in the fundus of the stomach. It appears like gas which is present in a pneumothorax, or a pneumoperitoneum, whereas the gas in the fundus of the stomach shows the structure of the rugæ and the stomach wall. As a final diagnostic measure, it might be necessary to remove the stomach contents by means



Figs. 4 and 5.

Fig. 4 (*above*). Case 1. Subphrenic abscess. A postero-anterior roentgenogram taken with the patient lying on his left side. Notice that the stomach did not reach the border of the ribs, showing that something prevented it from doing so, which, of course, was the fluid in the abscess.

Fig. 5 (*below*). Case 1. Subphrenic abscess. A right oblique view, in the erect position, with a tube in the patient's stomach, showing the fluid line to be anterior to the stomach wall.

of a stomach tube and note whether or not the fluid line in the suspected abscess is correspondingly diminished, or to give barium to the patient, thus determining definitely whether or not the air and fluid seen were within or outside of the stomach. Too much barium should not be given, for in case a diagnosis of subphrenic abscess is made, immediate operation might be necessary.

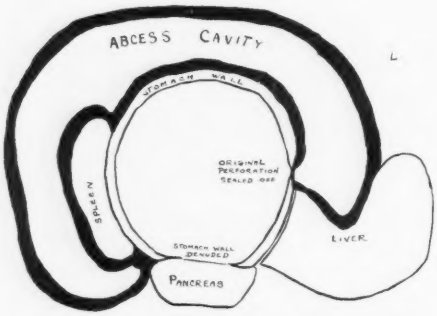


Fig. 6. Case 1. Subphrenic abscess. Diagram showing a cross-section of the abscess cavity found at autopsy. The dark border is the wall of the abscess cavity. The upper and the anterior border of the abscess cavity is formed by the dome of the left diaphragm. The lower border of the abscess is formed by the colon, adhesions to the anterior abdominal wall, and the lower edge of the left costal margin. The posterior border is formed by the left lobe of the liver and the posterior body wall. A small ulceration is found along the lesser curvature of the stomach about one and one-half inches from the pylorus, which probably marked the site of perforation, although it was sealed off. The upper and the posterior aspect of the stomach wall in an area of about four inches in diameter showed erosion of the mucous membrane and muscle of the stomach wall. The pancreas and surrounding tissue formed the base of the stomach in this area.

Fig. 7. Case 1. A roentgenogram, taken two years before the present admission, showing a prepyloric defect which was constant in all films. At this time a diagnosis of prepyloric ulcer was made. Gastric analysis showed a total acidity of 61 per cent and free hydrochloric acid of 50 per cent. No blood was present.

If the fluid seen in the left subphrenic region is within the stomach, as the barium is shot through the esophagus and strikes the fluid line, movements of the fluid wave can be seen. If the barium can be made to fill completely the area in question, with changes in the position of the patient, subphrenic abscess may be ruled out.

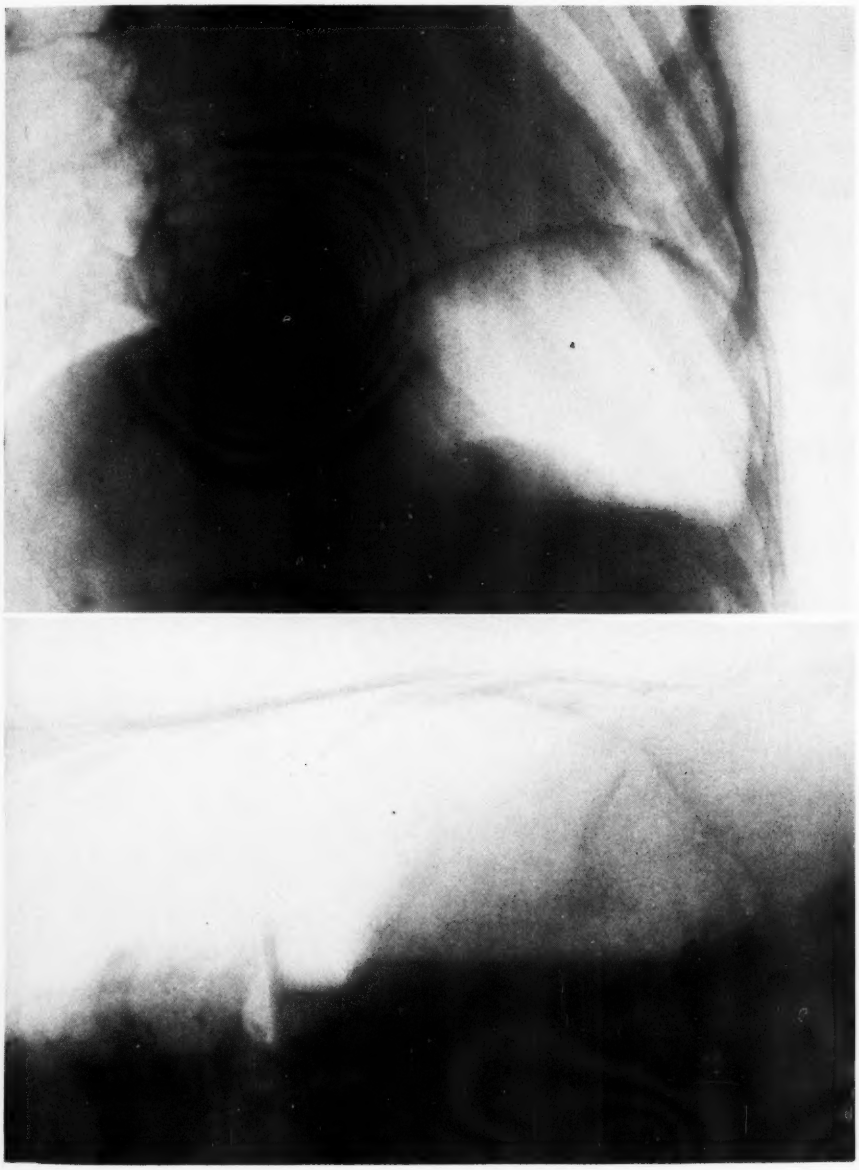
The temperature of the patient, the white blood count, and the leukocyte count will, in the case of subphrenic abscess, be high. One should hesitate to make a diagnosis of subphrenic abscess in the case of an individual whose temperature and white blood count are not high. Of course a patient may have an elevated temperature and white blood count and still have no subphrenic abscess.

It is hoped that the following case will be of assistance in the differential diagnosis.

Case 1. J. T., male, aged 54 years, came to the hospital complaining of epigastric pain of four weeks' duration. The pains were sharp and cramp-like. They were present almost continuously, and radiated to the back. The pains were slightly relieved by milk and sodium bicarbonate, which was about all the patient had taken for the past four weeks. The day before admission the patient ate some vegetables, one hour after which the pains became extremely severe. He did not vomit. On admission he was said to have a rigid abdomen, but the next day, when brought to the x-ray department, the abdomen was soft and was tender only on pressure under the left costal margin. The patient began to vomit blood the day after admission and died that day after a very severe hemorrhage.

This patient had had stomach symptoms for sixteen years. He had been a patient in our stomach clinic for six years, and was known to have a prepyloric ulcer, though

he had not presented himself at our stomach clinic since 1937, and had no symptoms from that date until the present illness. This ulcer had occasionally caused



Figs. 8 and 9.

Fig. 8 (*above*). A postero-anterior roentgenogram of a normal individual with a normal *magenblase* (gas bubble in the fundus) taken in the erect position. Note that the diaphragm is thin. There is no disease above the diaphragm. Fluoroscopic examination shows normal diaphragmatic excursions. In this case the left diaphragm was higher than the right, as a result of the great amount of gas in the fundus of the stomach.

Fig. 9 (*below*). A postero-anterior roentgenogram of a normal individual with a normal *magenblase* taken with the patient lying on his right side. Notice the gas within the stomach wall. While it almost reaches the upper portion of the rib margin, there is still a slight space between the stomach wall and the costal margin.

a 50 per cent six-hour obstruction, but most frequently no obstruction existed. His highest total acidity was 61 per cent, lowest, 46 per cent; the highest free hy-

Figs. 10 and 11.

Fig. 10 (*above*). An anteroposterior roentgenogram of a normal individual with a normal *magenblase*, taken with the patient on his back, shows that in a normal patient the stomach wall closely hugs the left diaphragm.

Fig. 11 (*below*). A postero-anterior roentgenogram of a normal individual with a normal *magenblase*, taken with the patient lying on his left side, shows that a normal stomach almost reaches the left costal margin.

drochloric acid was 50 per cent, the lowest, 33 per cent. He had never had blood in his gastric analysis. On his present admission the temperature was 103°, urine negative, and the blood count showed 46 per cent hemoglobin, red blood cells, 2,210,000, white blood cells, 40,000, polymorphonuclears, 90 per cent, small lymphocytes, 6 per cent, and large lymphocytes, 4 per cent.

When the patient was brought to the x-ray department, the fluoroscopic examination revealed a large amount of gas in the upper left quadrant below the diaphragm, and a large fluid wave. The diagnosis of a subphrenic abscess was considered, but until it could be definitely proved that the picture was not that of a large stomach filled with a great amount of fluid, with a large magenblase, various procedures were undertaken. Roentgenograms of this patient with a subphrenic abscess are shown in Figures 1 to 7. Roentgenograms of a normal left diaphragmatic region are given for comparison in Figures 8 to 12.

The first roentgenogram (*cf.* Fig. 2), a postero-anterior in the erect position, shows an elevation of the left diaphragm, a thickened diaphragm, and a small amount of fluid in the left thoracic cavity. A large gas bubble can be seen underneath the left diaphragm and a fluid wave below this. If the gas bubble is carefully examined, the outer portion is seen to be devoid of structure, a situation as seen in pneumothorax or pneumoperitoneum.

The second roentgenogram (*cf.* Fig. 3) is a postero-anterior view, taken with the patient lying on his right side. Notice that the gas bubble goes all the way up to the ribs themselves. Not even the spleen is visualized. Again the topmost portion of the gas bubble is devoid of structure.

The third roentgenogram (*cf.* Fig. 1) was taken after the patient had had some barium. This is an anteroposterior view, with the patient on his back and his hips slightly elevated in order that the fundus might be filled. Notice that the barium in the stomach did not reach the left diaphragm, as would be expected if the fluid seen in the upright position were in the stomach. The stomach also filled irregularly because of a great number of blood clots present.

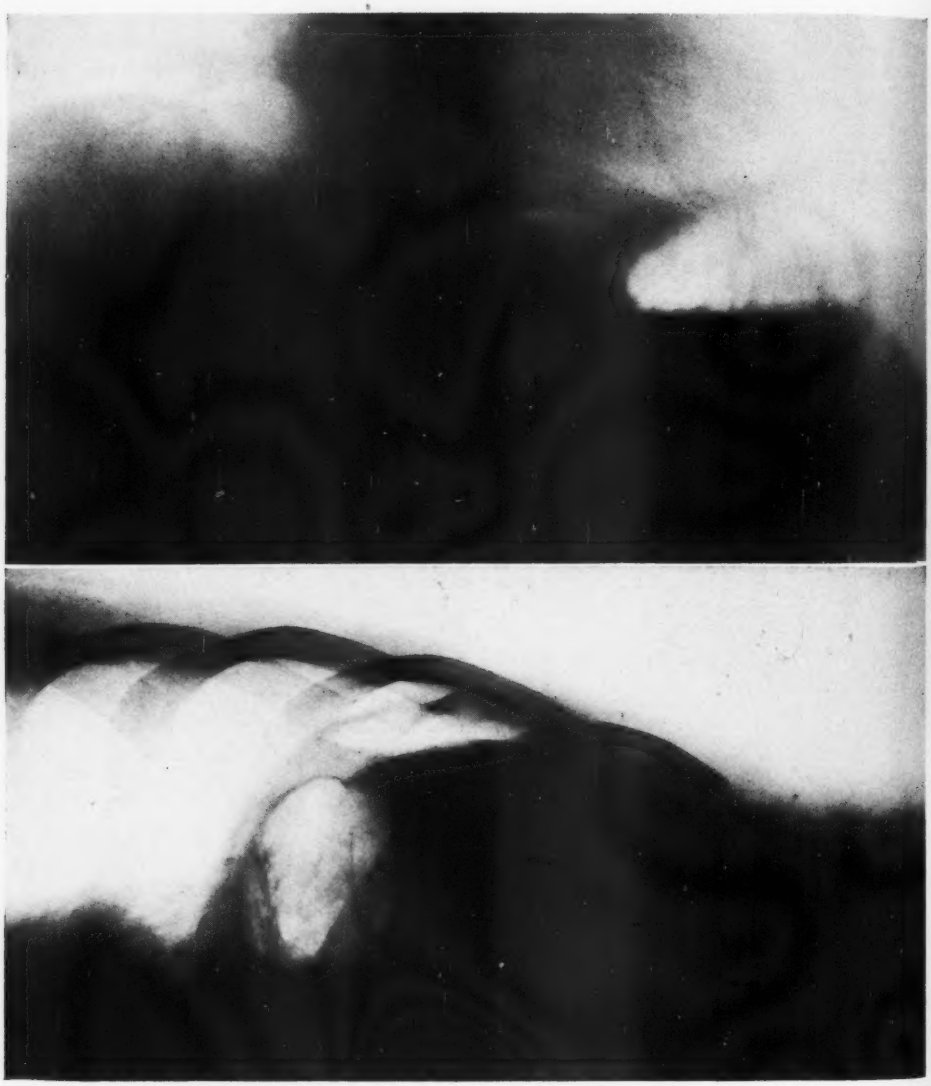
Figure 4 was taken with the patient lying on his left side. The barium does not reach the ribs, and a large space is present between the ribs and the lowest curvature of the stomach. This proved definitely that we were dealing with fluid outside of the stomach itself. Comparing Figure 4 with Figure 11, a roentgenogram of a normal stomach with the patient lying on the left side, it will be seen that in the normal case the stomach wall almost touches the lowermost costal margin.

An oblique view (Fig. 5), taken in the upright position, shows that the gas bubble and the fluid wave extend anterior to the filled stomach. A stomach tube can be seen passing into the stomach.

Autopsy showed a huge abscess, the upper and anterior border of which was formed by the dome of the left diaphragm. The lower border of the abscess was formed by the colon, adhesions to the anterior abdominal wall, and the lower edge of the left costal margin. The posterior border was formed by the left lobe of the liver and the posterior body wall. A small

Fig. 12. A left lateral view of a normal individual showing the gas bubble to be confined within the gastric wall. When the individual is given barium, waves can be seen fluoroscopically as the barium column strikes the fluid of the stomach.

ulceration was found along the lesser curvature of the stomach about one and one-half inches from the pylorus, which probably marked the site of perforation, al-



Figs. 13 and 14.

Fig. 13 (*above*). Case 2. Perforated peptic ulcer. A postero-anterior roentgenogram taken in the erect position shows the gas in the fundus of the stomach, and just outside and lateral to this a small gas bubble, a result of perforation, may be seen. The patient had no epigastric rigidity when this roentgenogram was made, six hours after admission, although he had had rigidity on admission. The left diaphragm is not thickened, not elevated, not fixed on respiration, and there is no disease in the chest above it. This film was made about six hours after the perforation. It will be several days before the infection will involve the diaphragm, spread into the thoracic cavity, and progress to a state of formation of much fluid and gas. Notice that the gas as a result of perforation is devoid of structure, whereas the gas in the fundus of the stomach shows rugæ markings.

Fig. 14 (*below*). Case 2. Perforated peptic ulcer. A postero-anterior roentgenogram, taken with the patient lying on his right side, shows the gas as a result of the perforation to be clear and distinct from the gas seen in the fundus of the stomach. It is uppermost, it reaches the costal margin, and it is devoid of structure, whereas the gas in the stomach wall shows the structure and the rugæ of the stomach through it.

Figs. 15 and 16.

Fig. 15 (*above*). Case 2. Perforated peptic ulcer. An anteroposterior roentgenogram, taken with the patient lying on his back, shows that the stomach wall hugs the left diaphragm, except in its outer portion. There is not much fluid in this perforation, and, therefore, it does not push the stomach noticeably away from the left diaphragm.

Fig. 16 (*below*). Case 2. Perforated peptic ulcer. A postero-anterior roentgenogram, taken with the patient lying on his left side, shows that the stomach wall does not come as close to the costal margin as it should normally. Therefore, some fluid accompanies this perforation, but not as much as is present in Figure 4.

Fig. 17. Case 2. Perforated peptic ulcer. A left lateral roentgenogram showing a small amount of gas below the left diaphragm. Just below this can be seen the gas bubble in the stomach. The uppermost diaphragmatic dome is the right diaphragm, the lowermost, the left diaphragm.

Case 2. This case of a ruptured duodenal ulcer with gas beneath the left diaphragm is inserted here to help make clear the differential diagnosis between gas in a left subphrenic abscess and normal gas in the fundus of the stomach.

G. S., male, aged 40 years, was awakened on the day of admission with severe abdominal pains localized beneath the xiphoid process. The pain radiated to the right shoulder occasionally, particularly if he moved the right arm. He vomited several times. This patient had never had a history of any gastric disorder before this time. Physical examination revealed rigidity and tenderness throughout the upper abdomen. About six hours later, when he was brought to the x-ray department, he had a slight epigastric tender-

Fig. 18. Case 2. Perforated peptic ulcer. A postero-anterior roentgenogram taken in the erect position about one-half hour after Figure 13, after the patient had been moved from side to side, shows that the gas, which had existed entirely under the left subdiaphragmatic area, is now, for the most part, present under the right subdiaphragmatic area. This shows that the gas and fluid were not entirely walled off. It was suspected, in this case, that, because the rigidity disappeared, the original perforation had been sealed off. At operation the perforation was found to be sealed off, and the gas and fluid were proven to be free in the peritoneal cavity.

though it was sealed off. The upper and posterior aspect of the stomach wall, in an area about four inches in diameter, showed erosion of the mucous membrane and muscle. The pancreas and surrounding tissue formed the base of the stomach in this area (Fig. 6).

ness, but no rigidity. His temperature was 100°, his white blood count 13,800, 79 per cent polymorphonuclears.

While a left subphrenic abscess might start this way, at this stage of the disease, *i.e.*, the first day, it would be just beginning to be localized, and several more days

would be necessary for the formation of an abscess wall and the progress of the disease. Figures 13 to 19 are roentgenograms taken of this patient. At operation a sealed-off perforation was found on the anterior surface of the duodenum. Free gas was found in the abdomen, which escaped as soon as the peritoneum was opened.

A postero-anterior roentgenogram (Fig. 13), taken in the erect position, shows the gas in the fundus of the stomach, and just outside of this a small gas bubble as a result of the perforation. Notice also that the left diaphragm is not thickened; it is not fixed on respiration; there is no disease in the thoracic cavity above it. The diaphragm shows pathologic signs only after the formation of the abscess.

Figure 14 shows that the gas as a result of perforation is clear and distinct from the gas seen in the fundus of the stomach. The former is uppermost and is devoid of structure while the latter shows rugæ markings through it.

A roentgenogram (Fig. 16), taken with the patient lying on his left side, shows that fluid must be present in this space because the stomach wall does not reach as far down as it normally should.

A left lateral view (Fig. 17) shows a small amount of gas beneath the left diaphragm. Notice that this gas lies just above the gas in the stomach. The upper dome density is due to the liver shadow.

Fig. 19. Case 2. Perforated peptic ulcer. A left lateral roentgenogram. Gas can now be seen under the right diaphragm (the uppermost diaphragmatic dome). Below this is a small amount of gas under the left diaphragm which is seen just above the gas in the fundus of the stomach.

Figures 18 and 19 show that an abscess wall had not entirely formed, because by the different manipulations the gas which was entirely limited to the left subphrenic area now can also be seen in the right subphrenic area.

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DELARIO, A. J.: Subdiaphragmatic Abscess. Am. Jour. Roentgenol. and Rad. Ther., **31,** 177–190, February, 1934.

RECORD FORMS FOR ROENTGEN THERAPY[1]

By R. R. NEWELL, M.D., *San Francisco*

A LARGE part of a roentgentherapist's practice has to do with cancer. In treating this desperate disease we habitually use a dangerous agent, right up to its tolerable limit. This makes precise quantitative records imperative. The use of fractionated dosage and multiple fields has become commonplace. These things make record-keeping burdensome. I have long sought to reduce the labor and yet protect my conscience.

I have recently asked some of my friends to let me see the way they keep their treatment records. An analysis of thirty, scattered all over U. S., shows:

(*a*) Some sort of printed form for daily record, all but 4.

(*b*) Standard R.S.N.A. form, 4.

(*c*) Similar principle of segregated record of physical factors, 3.

(*d*) Lines available for treatment entries, 8 to 55.

(*e*) Record folded in order to get more lines, 9.

(*f*) Back of sheet ruled the same as face, 5.

(*g*) Specially printed continuation sheet, 7.

(*h*) Special columns (4 to 6 of them) for segregating the record of accumulating total dosage on each field treated, 4. Another accomplishes the same purpose by skipping half a dozen lines before starting the entries on field No. 2, thus leaving room for enough entries (lines 2 to 7), presumably to finish up the record for field No. 1, at least for that course of treatments.

Item *a:* What is it that these four dislike about the printed forms? Undoubtedly the lack of flexibility. Also perhaps, the fact that when using such a printed form as the R.S.N.A. standard, one finds history and examination on one page, daily treatment records on another, and sketches, etc., on a third, and then has to turn back to the first for progress notes.

Items *a*, *b*, *d*, *e*, *f*, and *g*, in crescendo, proclaim that radiologists expect to treat many of their patients many times.

Item *c* emphasizes the desire to escape from the drudgery of recording every pertinent factor at every visit. One of those who uses no printed form sets forth all the factors at the first visit, and for subsequent visits enters only the exposure (in roentgens) and the field.

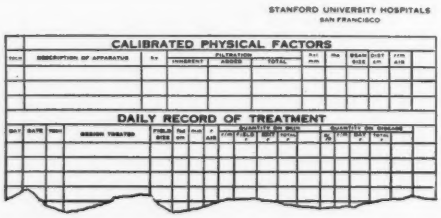
Item *h* shows a desire on the part of some to keep readily visible the momentary status of every treatment field.

Further Details of Treatment Sheets.— Ten have anatomic figures printed on their treatment forms, front or back. Ten use rubber stamps, and the rest may, too, data being incomplete.

One radiologist has listed his various factors and items in a long column followed by six columns across the page, enough for a week of daily treatments (except Sundays). All the others put their items as column headings as in the R.S.N.A. forms. I note the following headings among 21 examples (excluding R.S.N.A.).

Date: All but one have this at left margin, many wide enough for rubber date stamp.

[1] Presented before the Twenty-fifth Annual Meeting of the Radiological Society of North America, at Atlanta, Dec. 11–15, 1939.


STANFORD UNIVERSITY HOSPITALS
SAN FRANCISCO

CALIBRATED PHYSICAL FACTORS

DAILY RECORD OF TREATMENT

Fig. 1. The R.S.N.A. Standard Treatment Record. There are 31 lines for entering treatments. The back of the sheet is blank for notes or sketches.

Day of treatment (serial number of treatment day): Only one.

Kv., ma., distance, filter: All. Two, however, put some of these in a heading applying to all the treatments.

Time: All but one.

r per min.: Six.

h.v.l. or effective wave length: In six; both, in three of these.

r to field: All but two.

Location of field (sometimes by number): Nineteen.

Size of field, in cm. × cm. or cm.^{2}: In only 14, however.

Total accumulated to each field: Six.

Skin dose as well as air dose: One.

Depth dose: Three.

Exit dose: One.

Tumor dose: One.

Angle: One.

Thirteen require doctor to sign each treatment given, four of these by initials, two by name, six by initials of doctor and technician, one by two complete signatures.

It is obvious that those who have few columns leave out worthwhile detail, while those with many columns (average is 10, highest is 17) crowd their sheets and make much writing for each visit. Many of these radiologists have let me see examples of their record-keeping, and I am astonished to note how faithfully nearly all have made their daily entries in each column.

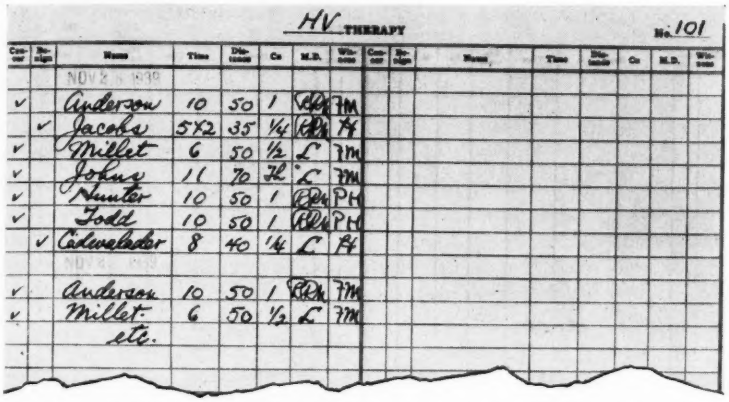


Fig. 2. "Filter Sheet" for attestation of factors used on each patient treated on each machine. Some workers would need extra columns for voltage, milliamperes, integron reading, where these vary from patient to patient. Some would not care to collect "cancer and benign." Aluminum or Thoraeus filters are conveniently abbreviated in the "Cu" column

Comparing these assorted records with the R.S.N.A. standard record, we see that the latter has 27 column headings, but only 16 for daily use. Eight of these are for "keeping books" on the dose accumulated at surface and in the depth. Few who use the charts enter in all the columns.

More than half keep a day book of patients coming to their office, and enter in it a record of each treatment as a check on the patient's chart. Four of these keep such a day book for each therapy machine.

Observing, as above summarized, that radiologists are making a deal of work out of their records in their attempt to be conscientious, I am led to inquire what, of all this, is essential—and perhaps what

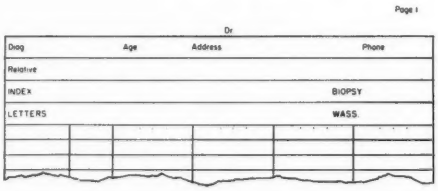


Fig. 3. Proposed simplified sheet for the patient's record. The form is ruled in pale blue or purple and printed in black. The back is ruled clear to the top, without printing.

opportunities are being missed to make the records even more useful. I think it is necessary, first, to inquire the purpose of the records. This is not simple. One desires:

A. A picture of the patient. Pertinent history and physical findings certainly come first.

For the picture of the patient's x-ray therapy one needs certainly the following:

1. Date of each treatment, its quantity and quality and the region or area to which applied.
2. A summary of what has been done in each area to date, *i.e.*, a picture of the momentary status as far as radiation therapy is concerned. This is a problem only in case of multiple sittings and multiple areas.

B. Dependable records of what has been done, in sufficient detail to obviate blunders or omissions, and for protection in case of complaint or suit.

1. Factors used to attain dosage given.
2. Signature or initial of person who actually gave the treatment.
3. Automatic records, perhaps, of the performance of the machine.

C. Economic and financial records.

1. Load of work, preferably distributed according to categories.
2. Charges and collections.

D. Scientific records.

1. Cross indexes of diseases treated.
2. Cancer studies, perhaps.

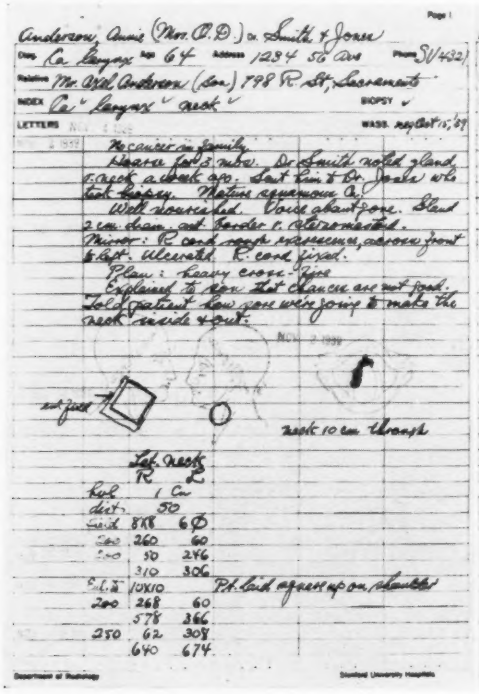


Fig. 4.

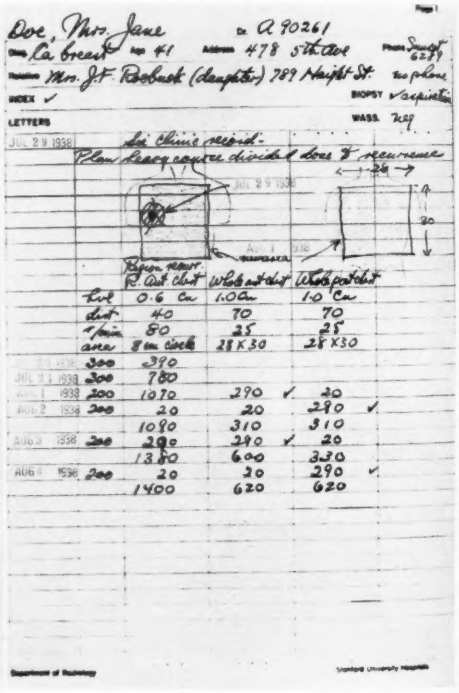


Fig. 5.

Fig. 4. Example of the use of new form. Treatment record is begun where convenient. The h.v.l., dist., and field headings are written in. They could be done better with a rubber stamp. In first column, each day, is entered the exposure given in roentgens in air. In the column, under region treated, is entered the measured or calculated skin dose (including back-scatter). In this case, account has been kept of exit dose. The day's dose is added onto what has been done at previous sittings.

Fig. 5. Example. In this case the clinical data are on other sheets. Supposing r per min. is considered an important datum, it is easy to record it. Here the dosage is accumulating to a different total in two regions within the enlarged anterior field. It is easy to keep track of both.

Paragraphs *C* and *D* will vary much in content and importance between one practitioner and another. I am here making no further attempt to analyze them.

Paragraphs *A* and *B*, however, are matters common to all radiation therapists. As I have separated them, I think it is evident that *A* carries all that is necessary for day-to-day acquaintance with the case as a problem in therapy, and that *B* carries data which are no less essential, but which can well be cleared off the patient's chart and put away in a safe place whence no one will carry them off to a consultation or on a house call and forget to return them.

A.—THE PATIENT'S RECORD

There are some things one can depend on oneself to enter without any reminder—these need not be printed on the record sheet. Other things, just as important, one may neglect to take care of unless nudged. Such are, *e.g.*, the patient's address, the names of physicians concerned, the names of relatives concerned, index, letters reporting to referring physician. Some of us, with unpleasant experiences in mind, might like to be reminded of the necessity of ruling out syphilis in every tumor case.

It would be convenient to have a per-

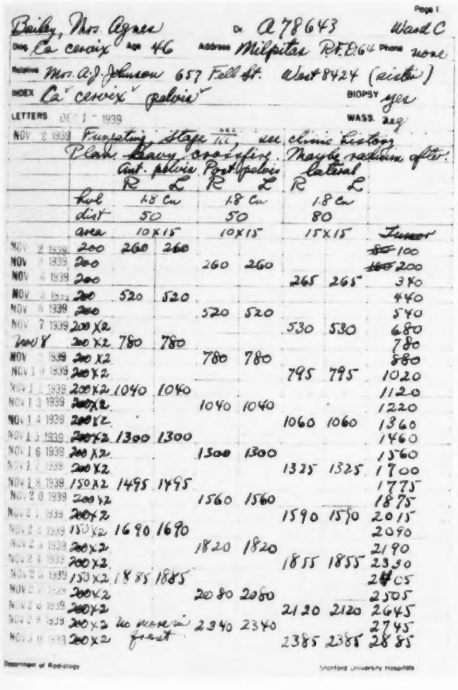


Fig. 6.

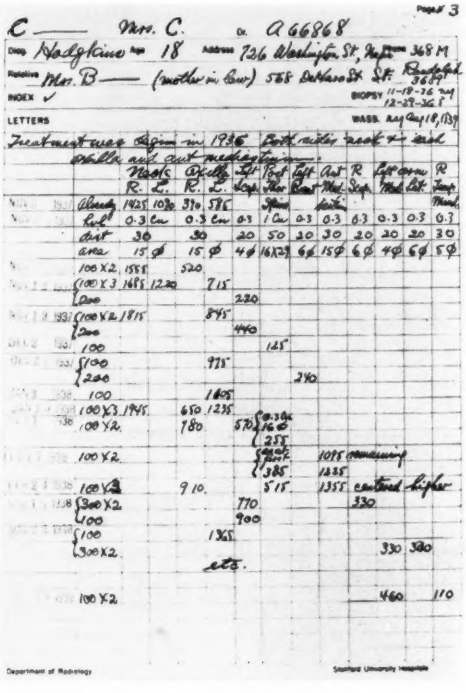


Fig. 7.

Fig. 6. Example. Again the clinical data are on other sheets. Record of treatment to six fields, ignoring the small exit doses on a thick patient, but keeping account of estimated tumor dose. The additions are done mentally. When two fields get the same exposure, one entry may suffice for both, the figures for skin dose under each of the two areas revealing that, in fact, two were treated. Or, if desired, one can indicate "multiplied by two" as has been done Nov. 7, *et seq.*

Fig. 7. Example. This is from the middle of the record of an actual case. Totals have been carried forward from page 2. It does not make any difference where one makes the entry, as, see Feb. 17, when 100 r was applied to a region not treated for nearly a year. The first four field headings were written in Nov. 5, the others not until treatment was begun (or resumed). Later this patient was treated over still other fields, and the pencilled divisions increasing the original four columns to twelve proved insufficient after all. Rather than add a fresh sheet, some of the columns were broken off and given new field headings. This makes the sheet harder to read. It is thought inadvisable to make the field columns narrower, however. And, of course, more than twelve areas are unusual. In fact, there is usually room in columns 3 and 4 to make entries concerning drugs and financial data.

fectly elastic space for entering history, examination, sketches or anatomic charts (rubber stamps are indeed convenient), and plan of treatment. One would then like to begin one's record of roentgen exposures immediately below this medical picture of the case; and one would like to be able to interrupt the x-ray record at will, to rearrange it or introduce new treatment fields, with new anatomic charts and sketches if needed.

The minimum essential data for each treatment are, as already listed: Date, quantity, quality (maybe dosage rate), and field exposed.

Conveniently, and if the record is to be let grow irregular or to suffer interruptions, then almost necessarily, the record should carry explicitly the status of dosage attained for each field down to date. It should be made equally convenient to keep track of total dosage in the tumor when one is treating deep-seated cancer.

B.—THE "FILTER SHEET"

The physical factors employed to attain the dose given, beside the time and the distance, are given at the top of the R.S.N.A. standard record sheet. If one keeps a separate "filter sheet" or book for each machine, then a single entry covers all for Description of Apparatus, and Inherent Filtration.

If, as is often the case, a given machine is always operated at a standard setting of voltage and current, these columns, too, are absorbed into the general title. The r per min. at given distances, with given beam sizes, with given filters, are established at regular intervals by a physicist's calibration. If output is kept constant by means of an iometer, then its reading need not be entered for each treatment. If ionization measurements are taken for each treatment with an integrating meter, then both this measurement and the time had better be recorded, as a check one on the other. If a given machine is operated sometimes at one voltage and sometimes at another, sometimes at 10 ma. and sometimes at 25, then the values must be entered each time on the "filter sheet," and, for safety, it should be made the witness' duty to check these as well as the filter.

Every department should keep a record of all measurements, adjustments, repairs, tube changes, etc., on its machines. These can well be kept in chronological, unassorted sequence in a bound volume. One such "log" could well serve all the machines in the department.

We have used the "filter sheet" with good satisfaction for a decade. Some might need extra columns for kv. and ma. and integron readings. Some might not care to segregate cancer from benign conditions. Figure 2 can, therefore, be taken only as a type to be modified for each worker, perhaps for each machine.

The patient's record, Figure 3, is the result of twenty years of dissatisfaction with daily therapy record keeping, during which time we have devised and put into use four printed forms, including a trial of the R.S.N.A. standard form. The simplifying device of entering only field, distance, quantity, and quality has proven thoroughly satisfactory. The bookkeeping for several fields, a column for each field, was developed with our second printed form—also the scheme of dots top and bottom to facilitate ruling the columns into halves or thirds when one is expecting to treat many fields (as in Hodgkin's disease, for example). Our earlier forms used printed headings for the factors. The achievement of elasticity by writing in the factors at whatever place one chooses to begin recording x-ray dosages—this is new. A rubber stamp could be made for them.

SUMMARY

After four attempts to improve record-keeping in roentgen therapy, and after observing how some other roentgenologists keep their records, a new record form is presented, which is thought to offer an improvement in simplicity and flexibility without loss of essential accuracy.

MUCOSAL RELIEF TECHNIC CORRELATED WITH GASTROSCOPY IN 150 CASES[1,2]

By CHARLES H. KELLEY, M.D.,[3] JOHN W. LAWLAH, M.D., *and* LEONIDAS H. BERRY, M.D., *Chicago*

From the Division of Roentgenology, Provident Hospital

TWO basic studies were fundamental to Berg's (3, 4) x-ray relief investigation of the gastro-intestinal tract. They were (1) the work of Forssell (13, 14) on the anatomy of the stomach and the movement of the gastric mucous membrane, and (2) Akerlund's (1) complete papers on the duodenal ulcer. Berg's work has been well known to roentgenologists for some time. His original monogram on this subject is classical. It seems superfluous to discuss the merit of his studies or those of his able contemporaries Cole *et al.* (10), Gutzeit (19), Holmes and Schatzki (20). Such discussions will be found in an increasing literature on x-ray relief technic. These workers had one aim in view—the anatomic demonstration of gastro-intestinal lesions. This does not connote that motor studies are less important: they are of definite value. However, if a lesion is present, the roentgenologist wants to demonstrate it on the film. If he is successful, much explanation will be unnecessary.

Since August, 1937, over 400 patients have been examined by the relief method. Many have been re-examined. A large majority of these patients were from the gastro-intestinal clinic of the Out-patient Department of Provident Hospital. Of this number, 150 have been gastroscoped. We shall discuss only the cases gastroscoped and x-rayed by the relief technic. The reason for the limitation is obvious. Some standard of comparison was necessary to test the accuracy of our x-ray relief findings. Nearly all cases were x-rayed before gastroscopy. By careful observation and analysis, we endeavored to record significant findings at fluoroscopy. To do this it was necessary to begin the examination with no preconceived ideas—a frequent cause of errors. If there were discrepancies between the gastroscopic data and relief findings, the relief examination was repeated.

It is not necessary to have elaborate

[1] Accepted for publication in April, 1939.

[2] Aided by a grant from the General Education Board.

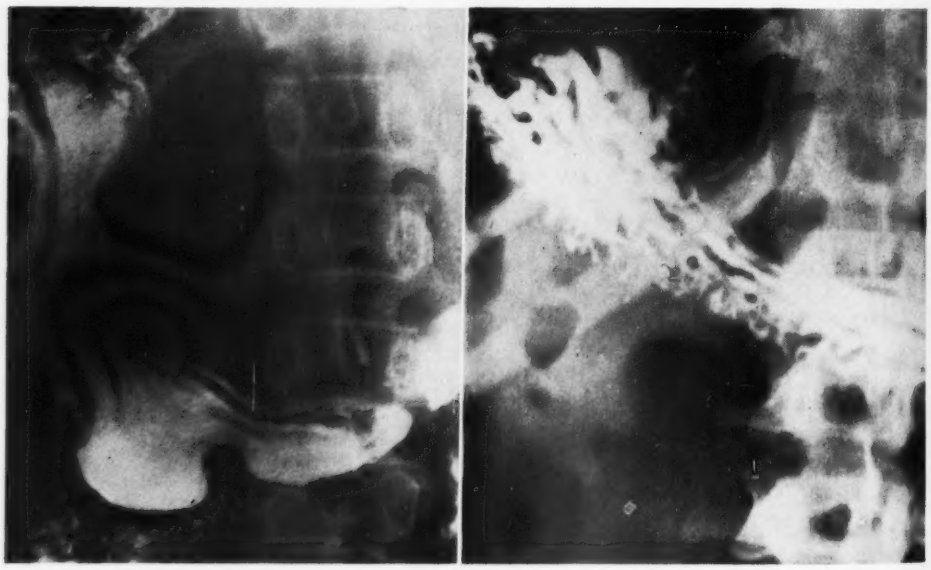
[3] Present address Washington, D. C.

A *B* *C*

Figs. 1-*A*, 1-*B*, and 1-*C*. Illustrations by the relief technic of normal variations of the gastric mucosal pattern. All cases were normal on gastroscopic examination.

machinery to do a good grade of x-ray relief technic. Some years ago Haudek remarked that "the equipment is more in the radiologist than in the machinery." It is possible to adapt this technic to one's gastro-intestinal equipment and obtain a film of good diagnostic quality. In our series the time factor in the average case varied between one-eighth and one-fifth second. It is exceedingly important to be able to switch quickly from fluoroscopy to roentgenography; if not, one will not see on the film the finding depicted at fluoroscopy. Forssell's (13, 14) publications stress the movement of the gastric mucous membrane. Preparation of the patient is the same as that required for routine x-ray examination of the stomach. In some cases lavage of the stomach is necessary to make sure it is empty. The examination is made with the patient in the vertical and horizontal positions and also from many angles. Films are made in the position best illustrating the lesion. Transparent cotton wadding was used for pressure pads. We found barium and water an adequate contrast substance. In most patients a single swallow of this mixture was used. Berg states that "the less contrast medium used, the more one sees." The amount of barium used and the degree of pressure applied should be left entirely to the judgment and experience of the examining roentgenologist.

Normal Relief of the Stomach.—It is necessary to keep clearly in mind a picture of the normal x-ray relief of the stomach in order to get a correct understanding of the abnormal (Figs. 1-*A*, 1-*B*, and 1-*C*). When a single swallow of barium and water is spread over the gastric mucosa, the pattern or inner relief of the stomach is seen. In average cases the folds in the cardia and the fundus appear as numerous anastomosing ridges formed by a network of folds and simulate the cerebral cortex. They are longitudinal and parallel on the lesser curvature. They usually diverge at the beginning of the antrum. They may cross over to the



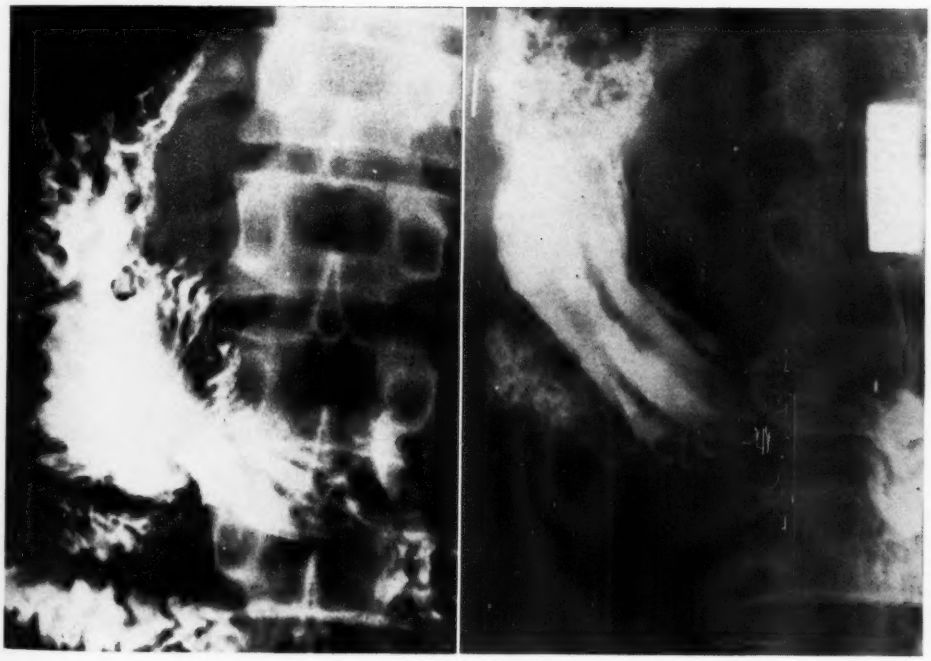
A *B*

Fig. 2-*A*. Roentgenologically normal mucosal pattern but diagnosed at gastroscopy as a case of atrophic gastritis.

Fig. 2-*B*. Roentgenologically normal mucosal pattern but diagnosed at gastroscopy as a case of erosive gastritis.

greater curvature at the pylorus. The folds are wave-like on the greater curvature, where many are seen end-on—pseudopolypoid formation. Some time ago, Forssell convincingly pointed out that these mucosal folds were formed by the contractions of the muscularis mucosæ. This point should not be forgotten if one attempts to correlate gastroscopic data with x-ray relief results. Obviously the gastroscopist has before him a picture of the stomach mucous membrane. We have encountered many variations from this description of the typical average normal picture of the inner relief of the stomach in cases labelled normal by the gastroscopist. One is not justified in making deductions merely from a derangement of the general architecture of stomach relief. Destruction of the folds or localized abrupt changes in their courses are different and significant findings. Their importance shall be alluded to later in the discussion.

Chronic Gastritis.—We refer to the modern concept of chronic gastritis ushered in by the invention of Schindler's flexible gastroscope, in 1922. This is the same clinical entity that Faber (15) endeavored to restore to its proper place of dignity, in 1904, at the Northern Congress on International Medicine. Unfortunately, his efforts were, in a large measure, fruitless. The reliability of the relief technic in the diagnosis of chronic gastritis is not generally accepted. Our series bears out the observation made by other workers, namely, that it is erroneous to assume that the size and caliber of folds indicate a particular type of gastritis. Salient relief findings are rigidity, warts or granules, and mottling. If present, these findings are of definite value in arriving at a probable x-ray diagnosis of chronic gastritis



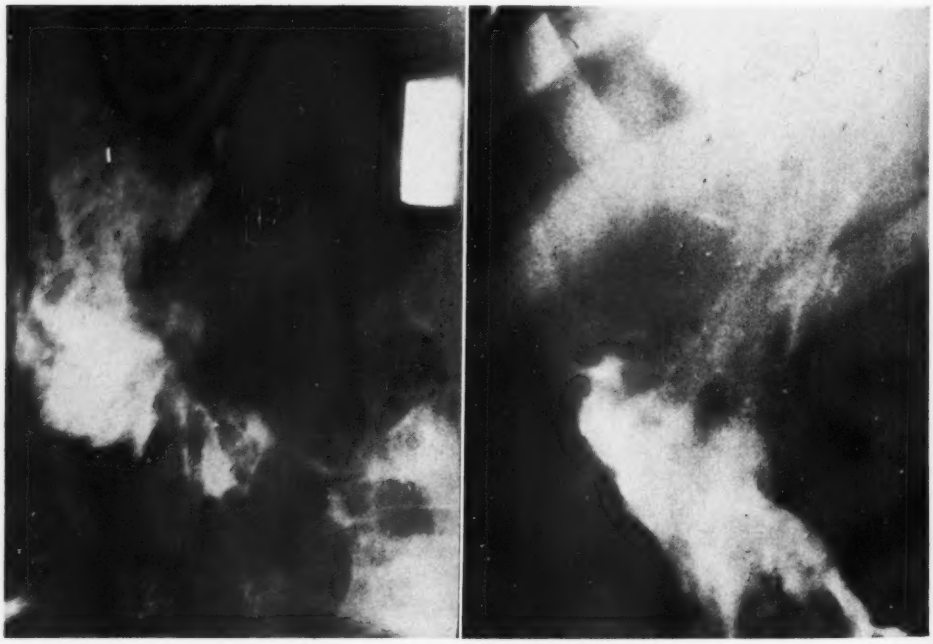
A *B*

Figs. 3-*A* and 3-*B*. Diagnosed roentgenologically as cases of chronic gastritis. Mucosal folds rigid on palpation. Films show mottling. Gastroscopically, *A* was diagnosed as hypertrophic gastritis, and *B*, as superficial gastritis.

(Figs. 3-*A* and 3-*B*). Warts are seldom depicted. They are often located between the folds where thick mucus and heavy contrast substance drown them (Henning, 22).

Without attempting to discuss any of the innumerable classifications of gastritis, we mention for sake of understanding our data that we follow the classification of Schindler (29, 30). It is as follows: (*A*) superficial or erosive gastritis, (*B*) hypertrophic gastritis, (*C*) atrophic gastritis, and (*D*) post-operative type of gastritis. This blends, in part, with the scheme advocated by Faber. In our series the deductions are that an anatomic diagnosis of chronic gastritis is hazardous and leaves too much to chance. We have not been able to illustrate erosions of the stomach mucosa in this disease as well as did Holmes and Schatzki (20). Further, we have been unable to correlate any specific associated motor disturbances of the stomach, stressed by some workers. (Figs. 2-*A* and 2-*B*). We have seen by gastroscopy severe grades of gastritis with no obvious functional motor disturbances. Thus we attach but little importance to the so-called motor disturbances associated with the disease.

Malignant Neoplasms.—Gastric carcinomas obliterate or destroy mucosal folds (Fig. 4-*B*). This is as it should be because of the destructive and invasive characteristics of such neoplasms. We did not find it practical to classify gastric carcinoma according to schemes used by the gastroscopist. We contented ourselves with determining the presence, location, and delineation of the borders of such a tumor, and with being able to state whether it simulated a scirrhous lesion or a bulky medullary carcinoma thrust into the lumen of the stomach. Properly done, relief technic is of distinct value in the diagnosis and study of these neoplasms.



A *B*

Fig. 4-*A*. Penetrating ulcer with a crater located at the angulus. Characteristic radiating folds are depicted by the relief technic. The crater and radiating folds were also seen at gastroscopy.

Fig. 4-*B*. Medullary exophytic carcinoma of pars media thrust deeply into the lumen of the stomach. The mucosal folds are obliterated. Gastroscopic examination confirmed the diagnosis.

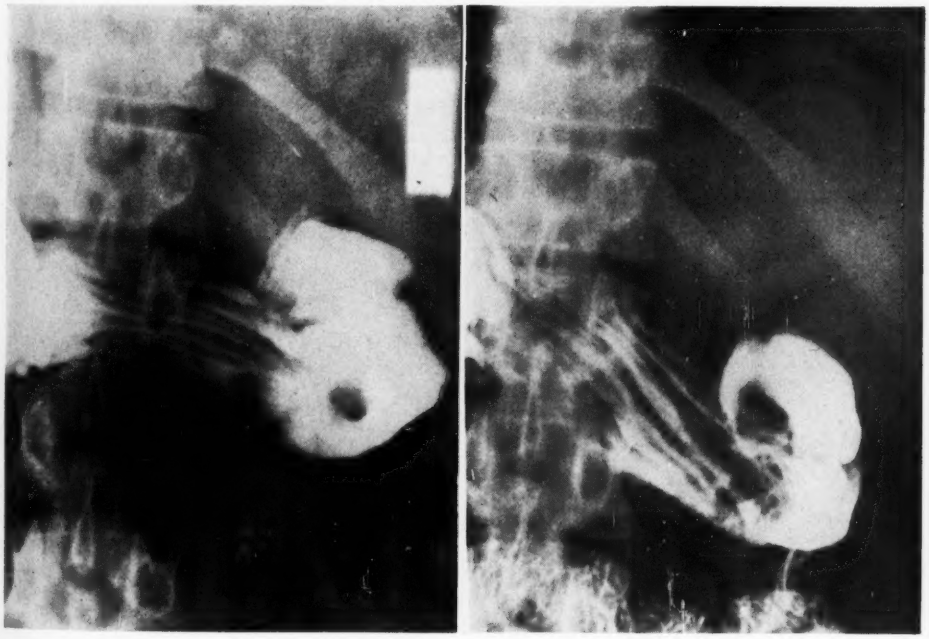
Adenomatous Polyp of the Stomach.—McRoberts[4] contends that these so-called benign lesions represent a stage in the development of malignant disease of the stomach. One of his cases returned with an inoperable gastric adenocarcinoma after a period of five years. Thus he strongly advocates surgery for these lesions. One case reported here is that of an adenomatous polyp of the antrum, without obstruction, occurring in a woman 38 years of age. Symptoms and physical findings were suggestive of an ulcer syndrome. X-ray relief technic illustrates how the regional folds abruptly change their courses to encircle the polyp (Figs. 5-*A* and 5-*B*). The folds are pushed aside in an orderly manner. It is important to note that they are not obliterated. The borders of the polyp are clean-cut. Later the polyp was verified by the gastroscope. Surgical measures were advised.

[4] McRoberts is quoted by Eusterman and Balfour (11).

Gastric Ulcer.—The description of folds radiating toward the ulcer crater has been emphasized many times before. It is true that they do so radiate, providing inflammatory edema, thick mucous material, or undetermined factors do not prevent the visualization of this classical picture. The above may account for the fact that the crater of the ulcer may be seen at one examination and not be visible on a subsequent examination or *vice versa*. One of our cases illustrates the former.

A classical picture of a penetrating ulcer located on the lesser curvature of the stomach close to the angulus is illustrated in Figure 4-*A*. The ulcer crater and radiating folds are well seen.

Pyloric Hypertrophy with or without Associated Gastritis.—Within recent years there has been a re-emphasis of this condition. Some investigators raise the question of in just what classification should this lesion be placed. We have seen fit to place three of our cases in this group.



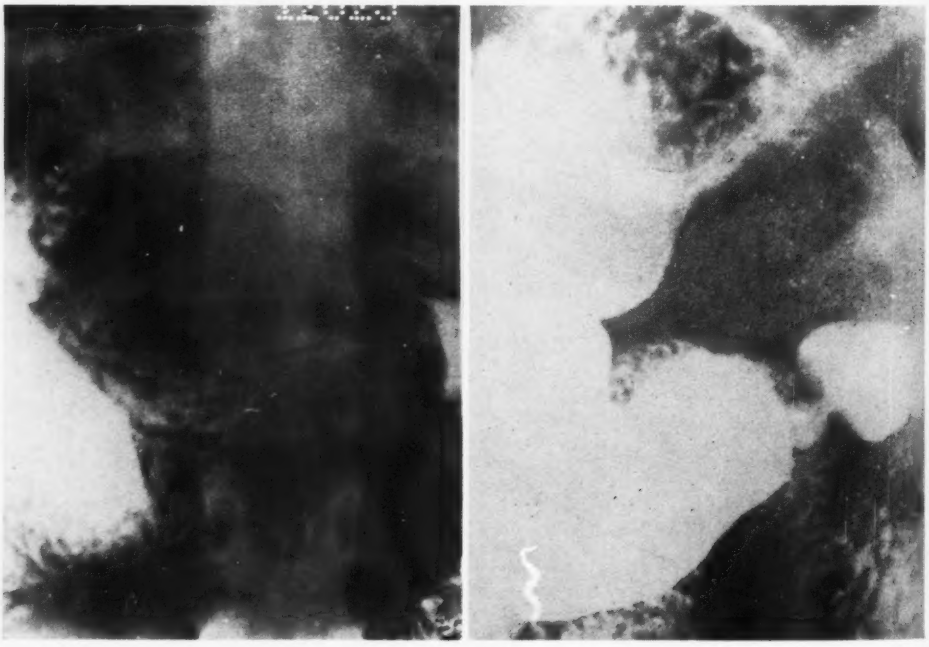
A *B*

Figs. 5-*A* and 5-*B*. Two views of an antral polyp. The regional mucosal folds are not destroyed. They encircle the lesion. The polyp was later seen at gastroscopy.

Significant findings were an elongated pylorus, absence of palpable mass, and preserved mucosal folds (Figs. 6-*A* and 6-*B*; and Figs. 7-*A* and 7-*B*). Golden (17) has pointed out the importance of the last mentioned finding. Two of the cases illustrated a concavity at the base of the bulb, a point stressed by Kirklin (26).

TABLE I.—SUMMARY OF CASES PRESENTED

		No. Cases	Percentage	Cases Diagnosed by Gastroscope	Cases Diagnosed by Relief
I.	Gastritis: Superficial or Erosive	21	14	All	Probable chronic gastritis; percentage accuracy not encouraging
	Gastritis: Atrophic	27	18	All	All
	Gastritis: Hypertrophic	12	8	All	Probable chronic gastritis; percentage accuracy not encouraging
II.	Gastric ulcer	3	2	All	All
III.	Gastric carcinoma	2	1.3+	All	All
IV.	Polypoid adenoma	2	1.3+	All	All
V.	Pyloric hypertrophy with or without gastritis	3	2	Examination incomplete in 2 cases; benign lesion inferred	All
VI.	Diverticulum in pars cardia	1	0.7	Not seen	Constant on repeated examinations.
VII.	Normals	79	52	All	Majority; several cases diagnosed normal had chronic gastritis; reverse less common.
	Total	150	100		



A *B*

Figs. 6-*A* and 6-*B*. Views of a stenosing non-obstructive lesion in the distal pylorus. From the x-ray data, differentiation between a benign inflammatory process and an annular carcinoma was impossible, although the evidence slightly favored the former because of the altered position of the antrum. Gastroscopic examination failed to show a neoplasm or ulcer.

Unfortunately, in two of the cases the gastroscopic examination was incomplete, although the disturbed position of the antrum during gastroscopy indicated adhesions and benignancy. The other case was reported by the gastroscopist as showing no tumor of the antrum but an inflammatory process was observed. Obviously an annular carcinoma of this region must be differentiated.

CONCLUSION

1. Data obtained from correlating x-ray relief and gastroscopy in 150 cases have been presented. We claim no priority or originality in this study.

2. We have illustrated some of the gastric lesions investigated in our series. These include benign and malignant gastric neoplasms, ulcers, and chronic gastritis. The relief method demonstrates these lesions accurately, with the exception of chronic gastritis. If one attempts a diagnosis of chronic gastritis, it should be done with great reservation.

3. This comparative study with gastroscopy has given us a better understanding of normal mucosal patterns depicted by the relief method. This is fundamental to the correct interpretation of the abnormal and often bizarre patterns produced by gastric lesions.

We are indebted to Frederic Templeton, M.D., for advice and encouragement. We acknowledge the kindness of Rudolph Schindler, M.D., gastroscopist. Leonidas H. Berry, M.D., gastroscopist, who is coauthor, made the large majority of the gastroscopic examinations.

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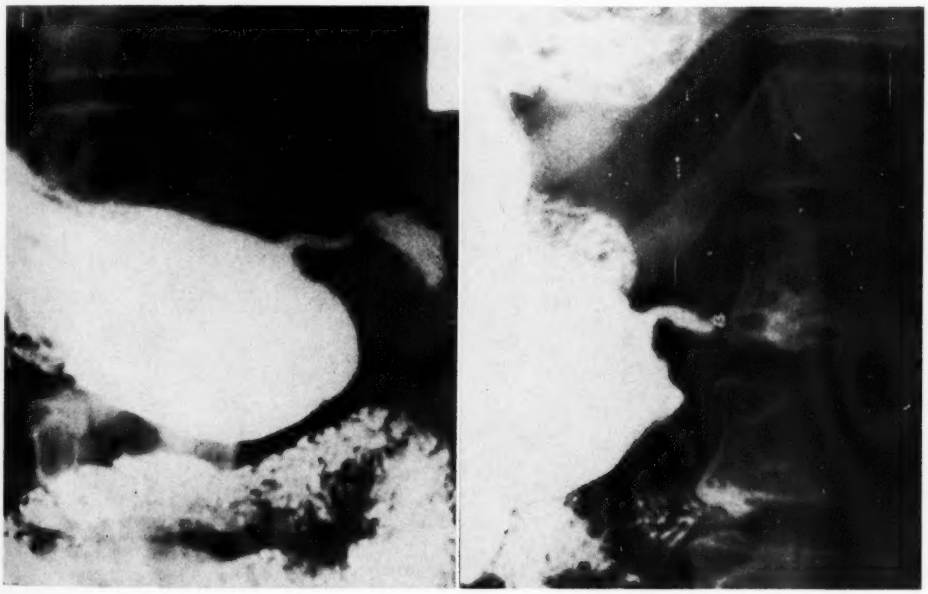

A *B*

Figs. 7-*A* and 7-*B*. Views of a stenosing non-obstructive lesion in the distal pylorus. From the films alone, it was impossible to exclude an annular carcinoma of the region of the stomach. Absence of a mass and pliable gastric walls at fluoroscopy were findings against cancer. The gastroscopic examination disclosed slight superficial gastritis. There was no evidence of an ulcer or a neoplasm of the pylorus. Observe especially the length of the pyloric canal and its eccentric position.

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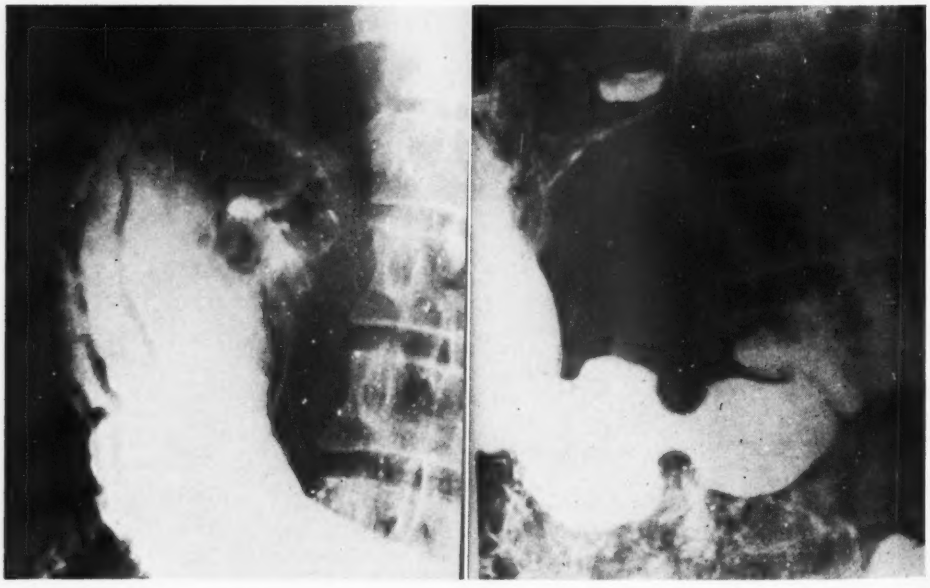

A *B*

Figs. 8-*A* and 8-*B*. A diverticulum located high on the posterior wall of the pars cardia. The lesion was constant on repeated x-ray examinations. It was not seen at gastroscopy, its location possibly being inaccessible to the gastroscope. A characteristic "clover leaf" deformity of the duodenal bulb is an incidental observation.

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SARCOMAS OF THE SMALL INTESTINE AND REFERENCE TO THEIR RADIOSENSITIVITY[1]

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ONE dealing with oncology is impressed by the marked infrequence of tumors of the small intestine. Among 986 tumors of the gastro-intestinal tract, Raiford (1) found only 88 (9 per cent) in the small intestine, 14 of which were in the jejunum. Heimann (2) found only 20 malignant neoplasms of the small intestine in 7,005 cases of cancer of the alimentary tract, excluding the mouth. Gidro (3), in his recent paper, reviewed the necropsy records of several Austrian, German, and Hungarian hospitals and found 47 cases of sarcoma of the intestine among 73,524 necropsies, of which 65 per cent were located in the small intestine. Feldman (4) collected 58 cases of sarcoma of the small intestine from 104,621 necropsy reports of five authors.

Only eight tumors of the small intestine were found in our 2,252 necropsies and 20,603 surgical specimens, while 75 neoplasms of the stomach and 108 neoplasms of the colon, including the cecum and rectum, were reported. The classification of these eight small-intestinal neoplasms is as follows: 3 leiomyoma; 1 leiomyosarcoma; 3 lymphosarcomas, and 1 carcinoma.

The cause of the relative infrequence of newgrowths of the small intestine is easily understood when a study is made of its special function, which necessitates much less irritation, both physical and chemical, than those of the remaining parts of the alimentary canal. The food particles traverse the esophagus and stomach in a more or less hard state and enter the small intestine as a soft semi-fluid material. The content of the colon becomes harder in consistency because of inspissation of water and has almost lost its soft fluid consistency upon reaching the rectum, where the fecal material is harder and much more irritating to the delicate mucous membrane of the colon and rectum. The reaction of the small intestine is alkaline which is much less irritating than the acid gastric juice. The colon wall is exposed to the irritating effect of bacterial toxins which are also normally absent in the small intestine. The food is stored for hours in the stomach and colon, but passes through the small intestine more rapidly, so that the physical and chemical effects and the other irritations caused by direct contact on the mucous membrane are diminished in the small intestine as compared to the stomach and colon. The small intestine develops from the primitive gut, like the other parts of the alimentary canal, so the intrinsic, histogenic factors of neoplasms are equal in the entire gastro-intestinal tract. However, the extrinsic factors—constant chemical and traumatic irritations—are so minimized, as compared with the mouth, esophagus, stomach, and colon, that the possibility of developing a neoplasm in the small intestine is extremely rare.

Histologically, the sarcomas of the small intestine are classified as fibro-, lympho-, leiomyo-, and miscellaneous sarcomas. The last group, according to Ewing (5), includes "a small group of ill defined and imperfectly described varieties." The majority of cases reported in the literature belong to the first three groups, with lymphosarcomas the most common. Our experience verifies these data, as we found three lymphosarcomas in a group of four sarcomas in our series.

Fibrosarcomas and those rare sarcomas grouped by Ewing as "miscellaneous" are excluded from this paper, as we did not observe them.

[1] Accepted for publication in December, 1939.

Leiomyosarcoma is a very rare neoplasm of the small intestine, 34 cases having been reported in the literature. Prey, Foster, and Dennis (6) collected 62 cases of primary sarcoma of the duodenum up to 1935, of which only four were leiomyosarcomas. The ratio of leiomyosarcomas, compared to other types of sarcomas of the small intestine, is 2 to 63, as estimated by Corner and Fairbanks (7), and 1 to 96 according to Speese (8). Leiomyosarcoma, like other neoplasms of the gastro-intestinal tract, is more common in males than females, the ratio being 3 to 2. The age incidence is wide. There are cases on record in every decade of life from the second to the eighth, though the fourth to the sixth decades are the age groups most frequently affected.

Age Incidence of 31 Cases of Leiomyosarcoma collected from literature.

From 1 to 10	.0
11 to 20	.2
21 to 30	.2
31 to 40	.8
41 to 50	.7
51 to 60	10
61 to 70	.1
71 to 80	.1
Over 80	.0

Location of 27 cases of Leiomyosarcoma

Duodenum	Jejunum	Ileum
5	12	10

Certain authors (Ribbert, 9; Boyd, 10; Klopp and Crawford, 11) did not accept the term "myosarcoma," believing "sarcoma" should be applied to tumors of connective tissue origin only, and suggested the term "malignant myoma" be used. Ewing (5) believes the name "myosarcoma" is permissible in a "morphological sense." Histologically, these neoplasms arise from smooth muscle cells and differ from benign myomatoma by the large, plump, uneven cells, hyperchromatic nuclei, frequency of mitotic figures, presence of mononuclear and polynuclear giant cells. The connective tissue stroma is either restricted or absent; cystic areas of degeneration are common. Morphologically, they are large, well defined nodular, solid, or cystic tumors, yellowish in color. In recorded cases the size varied from 2 to 20 cm. Steiner (12) reported a case in which the tumor weighed more than 15 pounds (7 kg.). Andersen and Doob (13) reported a case in which the tumor measured 15 × 18 × 12 cm. In our case, the diameter of the growth was 10 cm. Degeneration is a common finding in these growths; it was present as multiple softened areas in our case.

Clinically, these tumors are extrinsic or intrinsic polypoid growths. Since the extrinsic tumor is attached to a relatively small area of the outer wall and does not encircle it, obstruction is extremely rare. On the other hand, the pedunculated intrinsic growth, hanging on to the lumen of the intestine, may produce intestinal obstruction. (We had a fatal case of intestinal obstruction, in a 49-year-old white male, caused by a small benign intrinsic leiomyoma.) The extrinsic growths are more common in a proportion of 2.5 to 1. Demel (14) believes that extrinsic growths arise from the muscularis propria and the intrinsic ones from the muscularis mucosa. The clinical symptoms are quite uniform, according to the literature. Occult bleeding, manifest by tarry stools, is a common finding and most significant in the early stage. A movable abdominal mass and pain are relatively late manifestations. Intrinsic growths may produce an early partial intestinal obstruction and receive more attention from both the patient and the examining physician and will be discovered earlier than the extrinsic growth with its insidious and relatively symptomless course. In several cases, at operation or autopsy, metastases were found in different organs. Ghon and Hintz (15) reported a case in which metastasis occurred in the lung, liver, thyroid, pancreas, kidneys, suprarenals, gastric and intestinal mucosa, subcutaneous tissue, and several bones.

Roentgen examination of the gastrointestinal tract by motor meal has little diagnostic value in the early stage of an extrinsic tumor but is most valuable in the case of an intrinsic growth. The method is discussed and illustrated under lymphosarcomas in this paper.

The choice of treatment, if any, in all cases recorded was surgery. A careful search of the literature revealed no attempt of radiation therapy in these neoplasms. We believe our case is the first in which radiation therapy was applied to a leiomyosarcoma of the small intestine. At operation, numerous metastases were found practically all over the peritoneum, but, since there were no signs or symptoms of an intestinal obstruction, a resection of the intestine did not seem advisable. This patient was transferred to the radiotherapy department.

Since no leiomyosarcomas of the small intestine had been treated by radiation, we reviewed the literature for the radiosensitivity of myogenic tumors of other organs. Geschickter (16) states that leiomyosarcomas of the digestive tract are radioresistant. Phillips (17) believes that leiomyosarcomas of the stomach receive less benefit from radiation therapy than lymphosarcomas. The opinion of C. W. Mayo (18) is more encouraging. He reported a case of leiomyosarcoma of the cardiac end of the stomach in which complete removal of the tumor was impossible. He removed the major part of the growth and applied ten 50-mg. radium needles interstitially to the edges of the incision for 10 hours. The patient was well and symptomless two years following the operation, at which time the case was reported.

There are several cases of benign and malignant myogenic tumors of the pleura, kidney, bladder, and prostate recorded, but we could find no information regarding the radiosensitivity of these growths.

The literature on radiation therapy of benign leiomyomas of the uterus is extensive, but the question of the radiosensitivity of these tumors is still unsettled. All authors agree that radiation therapy decreases the size of the uterine fibroids considerably, but opinions are divergent concerning the mechanism of the action of roentgen rays. A majority of investigators believe that the artificial menopause and cessation of ovarian function following radiation affects the blood supply of the uterus and that reduction in size of the tumor is secondary to this altered physiology of the reproductive organs. Others, including Béclère (19), Nemenow (20), and Solomon (21), believe that roentgen rays and radium have a direct effect on myomatous tumors. Kelly and Burnam (22) reported two cases of complete disappearance of uterine fibroids following intrauterine radium application without cessation of menstruation, and a case of marked regression of the tumor in a case in which the patient had already passed the menopause. Yamasaki (23) produced regressive changes on myoma cells with 180 per cent of a skin unit dose.

Similar unison of opinion exists about the radiosensitivity of uterine leiomyosarcomas. Evans' (24) follow-up case histories do not indicate benefit from post-operative radiation. Steiner (25) reported a case of malignant myoma of the uterus with pulmonary metastasis in which roentgen therapy failed to reduce the metastatic growth. However, the patient had a "temporary subjective improvement" following radiation therapy. Dannreuther (26) advises post-operative radium treatment in all cases of uterine leiomyosarcoma. Schreiner reported eight cases of malignant myoma of the uterus in which only one patient received radiation therapy one month after operation, and this patient was clinically well four years and nine months following operation and at the time of publication of the paper. The seven cases which did not receive post-operative radiation had poor end-results. However, some palliation was gained in those seven cases by radiation of the metastatic lesions and recurrences. In our case, the tumor was definitely radiosensitive. It disappeared in seven weeks after the administration of 2,000 r units by 200

kv. technic. Better end-results would probably have been obtained had the patient returned for treatment of recurrence at an earlier stage.

From the limited information received from the literature and our own experience, we believe that leiomyosarcomas are radiosensitive tumors and that post-operative radiation should be given routinely in every case, even when visible metastasis is not found. Considerable palliative measures can also be gained by radiation in inoperable cases.

CASE REPORTS

Case 1. (No. 85,703.) A. J., 49-year-old female, married, entered the University Hospital on April 3, 1936, having, as her chief complaint, a hard mass in her right lower abdominal quadrant. She stated that a year previously she had begun to feel tired and worn out almost constantly. Six months before admission, she had noticed a hard movable mass which she described as the "size of a fist" in her right lower quadrant. Since that time, the mass had slowly increased in size.

The patient had also had backache, some frequency in urination, and almost constant constipation for four or five months previous to hospital admission. She felt she had lost some weight in the past few months but was not certain about how much.

Further history showed the patient had menarche at the age of 14 and regular menstrual periods up to the menopause, which had occurred eight years before the present illness. The patient had had two normal deliveries with healthy offspring (one 34 and the other 32 years of age at this time), and, then one stillbirth and a miscarriage approximately 20 years before the present history. The past medical history showed measles and mumps during childhood and an operation, in 1929, at which time the appendix, left ovary, and both tubes were removed. The family history was irrelevant.

Physical examination revealed a well developed, fairly well nourished white female who did not appear to be acutely ill. The head, neck, heart, lungs, and lymph glands were essentially normal. Blood pressure was 150/87. The abdomen was obese and showed the old mid-line suprapubic operative scar. There was a firm movable mass in the right lower quadrant, roughly spherical and about 10 or 11 cm. in diameter. Pelvic examination disclosed a fairly well supported perineum which had been repaired at one time. When the patient strained, a urethrocele was visible. The cervix was slightly enlarged and showed a bluish discoloration around the rather small external os. The vaginal mucosa appeared somewhat anemic.

On bi-manual examination, several irregular, nodular, non-tender, firm, movable masses, apparently connected with the uterus, were palpable. The uterus itself was in slight retroversion and was enlarged to about twice the normal size. Temperature on admission was 37° C.

Laboratory findings on admission revealed red blood cells, 4,550,000; hemoglobin, 70.5 per cent; white blood cells, 8,000, with 84 per cent neutrophils. Wassermann and Kline tests were both 4+. A roentgenogram of the chest showed no pulmonary pathology.

A diagnosis of multiple uterine fibroids was made, and on April 14, 1936, a laparotomy was performed.

At operation, the omentum was found to be adherent to the parietal peritoneum and there was a large, movable nodular neoplasm, about 10 cm. in diameter, which was attached rather intimately to one segment of the ileum. In the tumor mass there were a few soft fluctuant areas, apparently abscesses.

Numerous small metastatic nodules in the omentum, the visceral and parietal peritoneum were found. The liver was examined but contained no metastatic nodules. A gallstone about 2 cm. in diameter was found. The uterus was small, the right ovary normal, but both tubes and the left ovary had been removed. Three metastatic nodules were removed for biopsy. Microscopic examination showed

the tumor to be composed of irregular bundles, strands, and cords of smooth muscle cells. Sections contained numerous blood vessels and showed considerable hyalin degeneration. The microscopic diagnosis of leiomyosarcoma was made, but the individual cells appeared to be somewhat more immature than in the average tumor of this type.

Following operation, the patient made an uneventful recovery. On the fifteenth post-operative day she was discharged and then received a course of roentgen treatments, as an out-patient. A dose of 1,000 r units was given with 200 kv. technic to each of four fields on the anterior abdominal wall. In addition, as an out-patient, she received standard antisyphilitic treatment.

When she returned for a check-up examination seven weeks after her discharge from the hospital, she stated that she was feeling fine, her appetite was good, and she had been gaining weight and strength all the time. At this time, no abdominal mass was palpable, but the uterus was enlarged, slightly tender, and fixed. A return date for roentgen treatment was given, as six weeks later, at which time the patient was given 600 r units of additional radiation, by the previously described technic.

She returned to the out-patient department four months after this radiation therapy and was feeling well, had no bleeding, and was doing her own housework. Physical examination showed a large, moderately tender mass in the right lower quadrant, and the liver was enlarged and extended three fingers' breadth below the costal margin. It was noted that the patient was jaundiced to some extent. On pelvic examination, the uterus was found to be enlarged and incorporated in a large tumor mass which filled the right lower abdomen. The patient was advised to return for further antisyphilitic and roentgen treatment when her jaundice cleared up.

A month later, she still showed some trace of jaundice but was feeling well and had gained eight pounds. There had been no bleeding or abdominal pain. The abdominal tumor was, however, unchanged on physical examination. At the patient's request, further roentgen treatment was postponed for another month, but she failed to keep her appointment.

Six months later she returned complaining of severe constipation and inability to move her bowels at all except with strong cathartics or an enema. By this time, the tumor had increased in size until it filled the major part of the abdomen. The patient had lost considerable weight in this six-month period. Palliative roentgen treatment was given at this time.

Four months later, the patient was brought back in a state of collapse. She had been losing strength and her abdomen had enlarged rapidly in the past three weeks. She appeared to be in coma. There was a marked pallor and the skin was quite cold to the touch. Her temperature was 98.4° F., pulse 108, and respiration 28. She was breathing with her mouth open, a blank facies, and eyes fixed in a stare. The tumor mass filled the entire right abdomen and extended well over the mid-line. Pelvic examination was not performed because of the patient's moribund condition. She died shortly after admission, on April 5, 1938, two years after her operation. Permission for autopsy was not granted.

Lymphosarcoma has been known as a separate entity since Kundrat's work was published in 1893. Before his publication, this condition was grouped with various diseases of the lymphatic system termed as pseudoleukemias. Approximately 400 cases are recorded in the medical literature at the present time.

In the category of lymphosarcomas, or lymphoblastomas, is grouped a large number of lesions and names, many of which are confusing unless the reader is personally acquainted with the particular author's classification. We have adopted here the classification in use at present in Dr. T. B. Mallory's laboratory, at the Massachusetts General Hospital, recently revised by Dr. E. A. Gall.

The neoplasias of lymphoid origin are classified according to the cell from which they arise. From the original or stem cells of the lymph node arise the adult stroma cells and the parenchymal cells, from which the stem-cell sarcoma arises. The stroma, or reticulum, may then give rise to a reticulum-cell sarcoma or "clasatocytoma" and, somewhere along this line, Hodgkin's sarcoma and Hodgkin's disease may originate. In the parenchymal group there are: lymphoblastic lymphosarcoma, lymphocytic lymphosarcoma, and giant follicular lymphosarcoma.

The most primitive of the group is the stem-cell sarcoma. The stem cell, Hodgkin's sarcoma, and lymphoblastic types are highly malignant, causing death rapidly. The other four types vary considerably, as far as the length of life is concerned, but all are malignant. The reticulum-cell sarcoma may occur as a single lesion, cures of which have been reported following surgical removal. The slides on Case 2 (M. D.) in this series showed many large multinucleated Sternberg cells and very little associated inflammatory reaction in the tumor—quite obviously Hodgkin's sarcoma. This patient lived only 12 months after the onset of symptoms. In Case 3 (W. E. S.) there were well differentiated lymphocytic tumor cells and, occasionally, large interspersed follicles, indicating giant follicular lymphoma. This patient is still living five years after onset of symptoms. The tumor in Case 4 (L. R. T.) consisted of vast numbers of large round primitive stem cells, indicating a stem-cell sarcoma. The patient lived only 12 months after onset of symptoms.[2]

Lymphosarcomas arise from the submucosa of the lymphatics and produce an intrinsic, extrinsic, or an infiltrating lesion. The intrinsic type may be single or multiple polypoid growths protruding into the intestinal lumen (as in Case 3) and will, sooner or later, produce a partial or complete intestinal obstruction. The intestine proximal to the lesion is sometimes enormously dilated as the result of chronic incomplete obstruction. This occurred in Case 3.

The extrinsic types usually produce a subserous growth and sometimes penetrate through the serosa resulting in adhesions to neighboring intestinal segments and other intra-abdominal organs. This occurred in Case 4 and Case 2, respectively.

The intramural or infiltrating type produces an annular lesion which may be so extensive as to involve more than a single intestinal segment. Microscopically, the thickened rigid segment resembles a "garden hose" (10).

The age incidence is greatest between 25 and 45 years, and the relative high frequence in the first decade is amazing. The male sex, as in any kind of gastro-intestinal lesion, is more often affected, the ratio being 2 to 1.

Several attempts have been made to explain the etiology but without results. Trauma, syphilis, pre-existing ulcerative lesions, such as tuberculosis, typhoid, and colitis, were reported and considered as causative factors. Ullman and Abeshouse (28) found that an exceedingly high percentage of the cases recorded occurred in the working classes, which is quite impressive.

The clinical symptoms are indefinite and not characteristic in the early stages. Abdominal pain is always present but is not relieved by starvation and rest, as in most intestinal disturbances of infectious etiology (29). A palpable mass, observed in three of our cases, is a common finding, sometimes being discovered by the patient. There is always some irregularity of the bowel movements, constipation being the most common. Tarry or mucus stools, with alternating constipation and diarrhea, were observed. Urinary disturbances, secondary to pressure by a tumor mass, were observed in one of our cases. Similar effects on the liver and biliary ducts may produce jaundice. Symptoms of chronic incomplete intestinal obstruction are caused by narrowing of the lumen in the

[2] This information furnished by Hugh A. Stout, M.D., former Resident in Pathology at the Massachusetts General Hospital.

case of annular and intralumen polypoid growths. Acute obstruction occurs not infrequently by intussusception. No complete obstruction caused by stenosis is recorded. Perforation is exceedingly rare, only seven cases due to lymphosarcoma having been reported in the literature (30–36).

Roentgen examination has a definite and growing place in the diagnosis of lesions of the small intestine. An intestinal obstruction, complete or partial, can be diagnosed by a flat plate of the abdomen, and it should precede any study by administration of opaque material. Exact diagnosis can be made in many cases by the motor meal, a short fluoroscopic examination should be performed every 30 minutes following the barium meal, and a roentgenograph made when the lesion is located. In case symptoms do not indicate a well compensated incomplete obstruction, thorotrast solution is recommended to prevent a complete obstruction. Palpation under the fluoroscopic screen is a great help in determining the origin and direction of extension of the mass. The question of palpation, by naked hand, has been criticized, but, if used with care, it is not dangerous. A thin silk or cotton glove may help to filter out the softest and most dangerous rays. Since the roentgenologist can see more by palpation in the dark than the clinician can in the light, this advantage should be used and not underestimated. In two of our three cases of lymphosarcoma, roentgen examination was made and the origin of the tumor definitely located.

Fig. 1. Case 2. Note widened jejunal loop with loss of mucosal pattern at medial border; small defects at lateral border and circular defect at arrows.

The treatment in most of the recorded cases has been surgery. Only 28 out of 126 cases, collected by Ullman and Abeshouse (28), received roentgen therapy, 20 of them post-operatively. Though it is true that a well localized single tumor can be treated by surgery alone, the possibility of invisible metastases to the neighboring, or even quite distant, lymph nodes is always present. More than 50 per cent of the recorded cases showed metastasis at operation (28). Multiple lesions and single lesions having metastases are more feasible for roentgen therapy than for surgery.

The radiosensitivity in all types of lymphosarcomas is inherited from their parent cells, the lymphocytes, which are the most radiosensitive element of the human body (37). Since their radiosensitivity is evident, every case should receive at least a course of post-operative roentgen irradiation and results can be expected in practically all inoperable cases. Though good results can be expected by radiation, the danger of a fatal reaction is very likely if the treatment is not applied with extreme precaution. Since the lymphosarcoma is highly radiosensitive, a small daily dose of roentgen rays should be given to prevent severe and even fatal toxicosis, caused by rapid absorption of deleterious products of the deteriorating tumor. Another danger is heavy radiation over the infiltrated lymphosarcomatous intestinal wall, which will produce a peritonitis. The usual dose of roentgen rays applied in cases of carcinoma destroys the lymphogenic tumor cells so rapidly that regeneration cannot occur very soon

and the intestinal wall becomes permeable (38).

In our practice, we give 600 r units, 200 kv. and Thoraeus A filter to each field treated. In a daily dose, if one field is treated, 150 r are given, 100 r if two fields are irradiated daily.

Since all types of the lymphosarcoma are definitely radiosensitive and respond to even small doses of radiation within a few days, this property can be used for diagnostic purposes by the "radiation biopsy." Applied to an abdominal mass of unknown nature, 200 r units of deep roentgen ray will produce a recognizable diminution within 72 hours if the tumor is a lymphosarcoma.

Case 2. (No. 90,845.) On March 10, 1937, a well developed, well nourished, 46-year-old white woman was admitted to the hospital, with a colicky pain in her left side. The pain started just left of the umbilicus and radiated to the left abdomen and back. It had been constant for the past eight months. At times the pain would originate near the epigastrium and was always more pronounced after meals. It was of the burning type. Just previous to hospitalization, the pain had become so much worse that the patient was afraid to eat and she lost about 30 pounds in weight. About eight weeks previously, she "noticed a lump" in her left side which had gradually enlarged. On several occasions she thought this mass seemed to get smaller temporarily, but never to disappear. The pain had become much worse since the appearance of the mass and she had begun to feel very weak.

Her bowel movements had not been markedly irregular, unusual in consistency or color; they contained no blood, and she had no urinary difficulties. Menstruation had ceased about a year before.

Family history revealed that the patient's mother, aged 73, living and well, has a similar but larger mass in her left side, having had it for many years without any discomfort. The mother has recurrent chills and fever. The patient states she herself had malaria in childhood.

Physical examination revealed the head, neck, lungs, and heart essentially negative. The pulse was 80; blood pressure 130/80. A tender, movable, firm mass, the size of a grapefruit, was palpable in the middle left abdomen. The examining hand could be easily introduced superiorly between the mass and the left costal margin. The greatest tenderness was elicited on bimanual examination by compressing the mass.

Pelvic examination revealed a marked cystocele, definite retroversion of the uterus, and a moderate cervical erosion. The abdominal mass in question could not be demonstrated to be of pelvic origin or attached to the uterus. An intravenous pyelogram showed normal outline and function of kidneys, pelves, and calices.

Roentgen examination of the gastrointestinal tract showed the stomach and duodenum to be essentially negative. At about 15 cm. below the ligament of Treitz, there was demonstrated a slight widening of the jejunum for about 15 cm. The wall of the involved segment was rigid; the medial contour was smooth and showed no evidence of a normal mucosal pattern. There were several defects at the lateral contour of the segment and a large circular defect at the lower pole measuring about 3×3 cm. in diameter. The small intestine below the described segment showed a normal mucosal pattern and lumen. After two and one-half hours the described segment remained filled, although there was no retention above it and the jejunum below had emptied. This filled area was markedly tender on palpation; loops seemed to be fixed and could not be moved on manual palpation and manipulation. The x-ray findings suggested a tumor of the proximal segment of the small intestine with extension from the wall into the supplying mesentery. Lymphoblastoma seemed to be most likely.

Laboratory examinations did not reveal any helpful findings. The red blood cells numbered 4,300,000; hemoglobin, 80 per cent; white blood cells, 5,000, with 84 per cent neutrophils.

On operation, a tumor the size of a grapefruit was found. It was grossly firm, lobulated, fixed within the mesentery, attached to the jejunum, and bulging through the lesser peritoneal cavity below the transverse colon. A biopsy from the tumor mass was taken and microscopic examination revealed a lymphosarcoma of a highly malignant type in which the cells were entirely undifferentiated.

The patient made an uneventful recovery from her surgery. Roentgen irradiation was given to the affected area in two fields, 12 days after operation. She received 2,000 r units to each field, with 150 r as a daily dose. Two months later, after roentgen therapy was completed, she returned and had no complaints and no abdominal mass was palpable. A re-check of the gastro-intestinal tract by x-ray examination showed the previously present mass in the left upper quadrant to be absent. The upper jejunal segment remained somewhat wider and showed an irregularity of the mucosal pattern which was, however, less distinct than at the last examination.

Roentgen irradiation was repeated on June 14, 1937, the patient receiving 1,200 r to two anterior and two posterior fields with 200 r as a daily dose. She never returned after this series of roentgen treatment and we were notified that she died on Aug. 3, 1937. No details of her terminal stage were received.

Case 3. (No. 79,743.) On March 25, 1935, a white man, farmer, 39 years of age, was admitted to the University Hospital complaining of "indigestion" and distress very soon after eating, also bloating and abdominal pain. The pain was dull in character, began in the left upper quadrant and radiated down to the mid-abdomen. It was not relieved by food but was partially relieved by soda. The onset of these symptoms was quite gradual, having begun several months prior to admission. About two months before entry, he noticed a firm tender mass just to the left of the umbilicus. He was moderately constipated but noticed no abnormality in the appearance of his stools. During the past few weeks he had been nauseated and had vomited occasionally—sometimes with the aid of his finger—which gave him marked relief. The patient also had slight frequency and nocturia. Family history was non-contributory.

Physical examination showed a well developed and nourished 40-year-old man in no acute distress. There was a firm, nodular, freely movable mass about 8 × 12 cm. lying transverse in the mid-line of the abdomen just below the umbilicus. The remainder of the examination was essentially negative: the blood pressure was 110/70; temperature 98.8°; pulse 74; respiration 18. X-ray examination of the gastro-intestinal and urinary tracts revealed no evidence of abnormality. The red blood cells numbered 4,400,000; hemoglobin was 85 per cent; white blood cells, 6,200; 82 per cent polymorphonuclears. Wassermann and urine tests were negative.

An exploratory laparotomy was decided upon, with pre-operative diagnoses of (1) newgrowth in the omentum; (2) newgrowth in the small intestine. The operation revealed a hard nodular mass in the lower part of the ileum measuring 8 × 14 cm. The small intestine, proximal to the tumor, was considerably dilated and mesentery of the ileum in this region was markedly thickened and edematous, but no lymph nodes were noted. There were no nodules in the liver. At operation 45 cm. of the ileum was resected and a side-to-side anastomosis done.

The gross pathologic examination showed an almost complete obstruction of the mid-portion of the removed segment, due to the presence of a submucosal, soft, irregular, nodular mass protruding into the lumen and extending into the wall of the intestine as well as into the mesentery. One section of the tissue was gray, glistening, and soft but fairly dense and not fibrous. Microscopic examination showed an intact mucosa and a very thick submucosa consisting almost entirely of lymphoid tissue. A few large irregular-shaped follicles were present, but many

large areas showed closely packed cells in which there were no follicles. The tumor consisted of small spheroid and ovoid cells with fairly dark staining nuclei and occasional mitotic figures. Most of the cells were round with a high grade of differentiation. Logically, the tumor fell into the category of giant follicular lymphosarcoma.

The patient made an uneventful postoperative recovery. Five weeks after operation a course of x-ray therapy was given which consisted of 1,400 r units to a 20 × 20 cm. anterior field and a similar amount was administered posteriorly.

Two and one-half months after admission, the patient was discharged and instructed to return in three months. He did not return until Nov. 29, 1937 (two and one-half years after discharge), stating he had been essentially symptomless until one month prior to his second entry. At this time, he noticed blood and mucous in the stools. A year previously a "lump" appeared in the mid-abdomen but was associated only with slight constipation.

Examination showed an 8-cm. tumor mass in the mid-line just above the umbilicus immediately to the right of the old operative scar. A second course of x-ray therapy was given through a 10 × 10 cm. field consisting of 3,000 r units by 200 kv. technic. Roentgen examination, on Nov. 30, 1937, failed to reveal any abnormality of the gastro-intestinal tract. Blood disappeared from the stools during roentgen therapy and on Dec. 24, 1937, the patient was discharged.

He returned two months later for a check-up, at which time no tumor was palpable. He had gained weight and strength and had no complaints. Although instructed to return every three months, he was not seen again until July, 1939. He had lost a moderate amount of weight and complained of weakness, marked constipation, gaseous distention, and belching. There was a constant dull distressing sensation beneath the old operative scar. Examination showed a slightly emaciated, pale man, chronically ill. No tumor mass could be palpated in the abdomen. Blood examination showed white blood cells, 2,400; red blood cells, 3,300,000; platelets, 93,240; reticulocytes, 12 per cent. The patient was given transfusions, iron, liver extract, and supportive therapy but no radiation. He was discharged on Aug. 12, 1939, and four days after he had severe pain in his lower abdomen and vomited several times. He was given morphine and sent back into the hospital, at which time supportive treatment was given and he was discharged on Sept. 1, 1939.

Case 4. (No. 98,304.) L. R. T., a five-year-old white male, was admitted to the University Hospital on Sept. 6, 1938, with a history of progressive abdominal enlargement. Upon examination it was learned that the abdominal enlargement was evenly disseminated, had been noticeable only during the past twelve months, and had become markedly enlarged within the past two months. However, the patient had gained only two pounds in the past year, during which time he had occasional spells of bloody vomiting. Bowel movements were regular but contained blood. He had

Fig. 2. Case 4. Note pressure defect on cecum and filling defects on terminal ileum.

no abdominal pains, urinary complaints, night sweats, or cough, but had an increasing dyspnea.

Examination also revealed the abdomen to be markedly distended. A large irregular-shaped fixed mass was palpable in the right side, extending from the region of the cecum well over to the mid-vertical line and nearly to the rib margin on the right. Anterior and posterior cervical lymph nodes and axillary lymph nodes were enlarged bilaterally. Veins were prominent over the lower chest. Other findings on admission were: temperature, 99°; pulse, 102; respiration, 20; red blood cells, 4,410,000; hemoglobin, 85 per cent; white blood cells, 9,200 with 60 per cent neutrophils. The urine was negative.

Roentgen examination of the colon showed a large filling defect of the medial aspect of the cecum, apparently due to extrinsic pressure. The cecal mucosa was intact and a few small filling defects were demonstrated at the region of the terminal ileum. Motor meal showed no abnormality of the upper small intestine.

The patient was operated upon on Sept. 26, 1939. The abdomen was opened by a right rectus incision. The omentum was thin and contained grayish nodules varying in size from 1 to 10 mm. in diameter. There were many hard and moderately smooth masses matted to each other, involving the small intestine and affixed to the stomach and large intestine. The liver was somewhat smaller than normal and smooth. A moderate amount of milky, turbid fluid was found in the abdomen. Two biopsy specimens were taken from the omentum; none from the intestinal tissue. Microscopic examination of the omental tissue showed it to consist entirely of tumor composed of very poorly differentiated, very small dark staining cells which were quite embryonic in appearance. Although the cells were small, there was some variation in size. Arrangement was in compact masses and sheets. There was little stroma, and numerous newly formed vessels were found. Some areas were infiltrated with fat. Nuclear material predominated and many mitotic figures. The microscopic diagnosis was lymphosarcoma.

Recovery of the patient was without event. The operative wound healed normally and a course of roentgen therapy was given through four anterior portals to the entire abdomen. These treatments consisted of 400 r units to each field by 200 kv. technic. A second course of roentgen treatment was given six weeks after the first was completed. This second irradiation series was through four anterior and four posterior portals and consisted of 400 r units to each field. The lesion did not respond favorably to x-ray treatment but no discomfort or any other declination was noticed.

The patient was discharged from the hospital as hopeless and died three months after dismissal. No information as to this terminal stage was available.

CONCLUSIONS

1. Four cases of sarcoma of the small intestine, one myogenic and three lymphogenic types, have been reported.

2. Leiomyosarcoma is extremely rare in the small intestine, only 35 cases having been recorded. Lymphosarcoma is more common, with approximately 400 cases known in medical literature.

3. The age incidence is quite wide in both types of sarcoma, there being records of lymphosarcomas in every decade of life, the first, third, and fourth being the most frequent. Leiomyosarcomas are known from the second to eighth decade, the fourth to sixth decade being the most frequent.

4. The largest percentage of tumors of the small intestine which have been recorded have occurred in males, the ratio being 2 to 1 in lymphogenic and 3 to 2 in myogenic sarcomas.

5. The most common location of lymphosarcoma is the ileum, and for leiomyosarcoma, the jejunum.

6. Palpable tumor, occult bleeding, and abdominal pain is the classical triad of symptoms, unfortunately not always found simultaneously.

7. A high percentage of cases could be diagnosed by a careful roentgen examination of the small intestine.

8. The lymphosarcomas are so radiosensitive that a small dose of roentgen ray can produce diminution of the tumor mass and serve for diagnostic purposes. The tumor mass completely disappeared in our case of leiomyosarcoma after administration of 2,000 r units of roentgen ray.

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ROENTGEN THERAPY FOR PSORIASIS OF THE NAILS AND PSORIATIC ARTHRITIS[1]

By WALTER C. POPP, M.D., Section on Therapeutic Radiology, The Mayo Clinic, *and* ERCELL A. ADDINGTON, M.D.,[2] Fellow in Radiology, The Mayo Foundation, *Rochester, Minnesota*

PSORIASIS of the nails is usually characterized by pitting, brownish discoloration of the nail bed, leukonychia, cracking of the free edges, and subungual hyperkeratosis.

Among the remedies suggested for treatment of this lesion, the use of roentgen rays is one of the most prominent. Most writers suggest treating the nails after carefully protecting the nail base from the roentgen rays. Because of the fact that arthritis of the distal joints of the hands or feet (or both) occurs not infrequently in cases of psoriasis, we have tried, during the past five years, a different method of treatment with roentgen rays, applying them to the dorsum of the hands in a field extending from the nail tips to the wrists, and to the dorsum of the feet in a field from the tips of the nails to the ankles. We have used this method of treatment whether the individual patient did or did not have arthritis as a complication of his psoriasis.

We have given treatment in 24 cases in which the diagnosis of psoriasis of the nails was unquestionable. Of these, six showed involvement of the fingernails only, and 18 showed involvement of the nails of both hands and feet. Of these 24 patients, nine had arthritis of the distal joints. The history of the patients with arthritis complicating psoriasis is interesting because, with development of psoriatic changes in the nails, there was usually a definite exacerbation of arthritis with pain and periarticular swelling. Roentgenologic studies of the joints showed no definite changes, but only some periarticular swelling.

In this series of cases, the average duration of symptoms was approximately seven years. The shortest duration was three months and the longest twenty years.

The method of roentgen therapy in this series of cases has been to expose the hands or feet in the manner mentioned previously. The treatments are given with roentgen rays generated at approximately 130 kv., constant potential, filtered through 4 mm. of aluminum for the hands, and through 6 mm. of aluminum for the feet. The dose for each treatment is about 300 r (measured in air). The treatments are usually repeated twice, at monthly intervals. After the third, no further treatments are given. We feel that at least three months must be allowed to elapse before the results can be definitely evaluated. In the cases in which arthritis was a complication, symptomatic improvement has been manifest after the first treatment, but at times an exacerbation of the pain and stiffness in the joints may be noted in the first few days after a treatment has been given. This exacerbation can be disregarded, as it lasts only a few days and quickly subsides.

The results of treatment have been gratifying to us because in six cases complete remission of all changes in the nails occurred and no exacerbation has occurred to date. Ten cases showed very marked improvement to the point that no subsequent treatment has been necessary, the lesion in the nails remaining quiescent. In two cases, no improvement whatever occurred. There were nine cases in which arthritis was present. One of these patients could not be traced. Of the remaining eight cases, complete symptomatic relief occurred in four and marked improvement in four.

The beneficial results in this series of cases have lasted from six months to as

[1] Accepted for publication in April, 1940.

[2] Now residing in Spokane, Wash.

long as five years. The remission of symptoms is of variable duration due to the difference in intervals since the last treatment was given.

Roentgen therapy is by no means recommended as a cure for psoriasis of the nails and psoriatic arthritis and, since the natural course of psoriasis is toward recurrence under any treatment, the beneficial effect on these complications of psoriasis, even though marked, will be, at best, only temporary. The same well known difficulties will probably arise with repetition of treatment with roentgen rays as has constantly arisen in the treatment of psoriasis of the skin. We feel that the same precautions in repetition of treatment must be observed in treating psoriasis of any portion of the body. We do believe, however, that the procedure of treatment which we have outlined is helpful in overcoming the marked disfigurement of the nails of persons who have psoriasis as well as in relieving the symptoms of psoriatic arthritis and that better results are obtained when the whole hand or foot is exposed to roentgen rays than when only the nails are treated.

THE MEASUREMENT OF THE DEFORMITY OF ALIGNMENT ACCOMPANYING FRACTURE[1]

By CLAYTON R. JOHNSON, M.D., *Whittier, California*

From the Murphy Memorial Hospital

IN the description of fracture deformity as shown on the roentgenogram, it is desirable to denote the type of fracture, its location with relation to adjacent joint surfaces, the character and amount of displacement, and the alignment of the fragments. Of all these, the deformity of alignment is probably the most important, especially in cases in which the fracture is

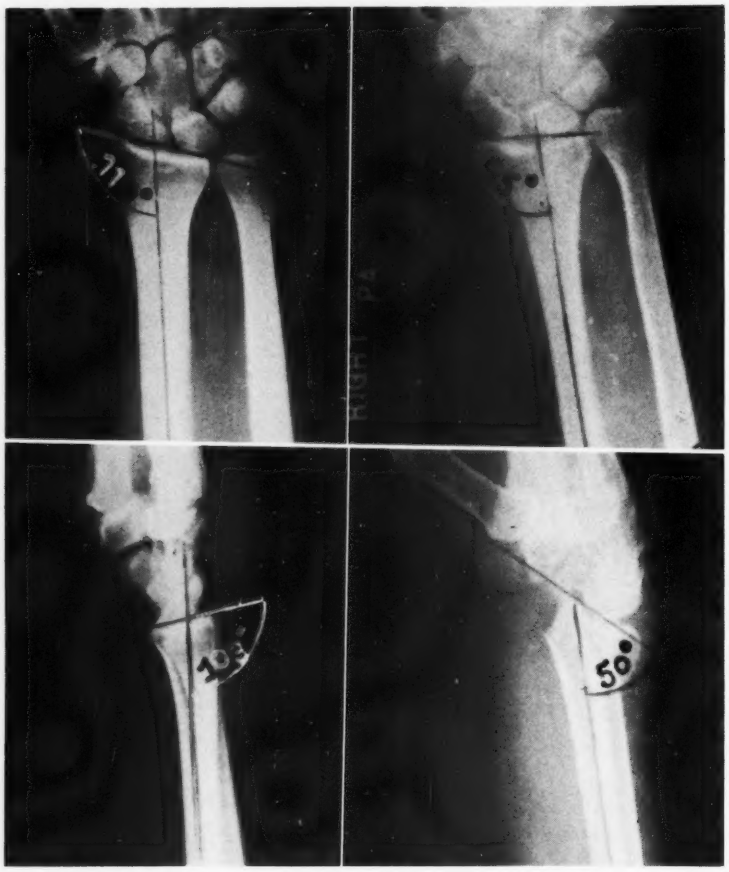

Fig. 1-*A*. Upper left shows normal lateral radial angle of 110 degrees. Upper right shows usual deformity accompanying fracture with lateral radial angle of 95 degrees.

Fig. 1-*B*. Lower left shows normal dorsal radial angle of 103 degrees. Lower right shows usual deformity with dorsal radial angle of 50 degrees.

[1] Read before the California Medical Association, Section on Radiology, at the Sixty-seventh Annual Session, at Pasadena, May 9–12, 1938.

near a joint, and is, perhaps, the one most difficult to describe accurately.

I wish to propose a method of measurement and description of the deformity which has proven both practical and useful.

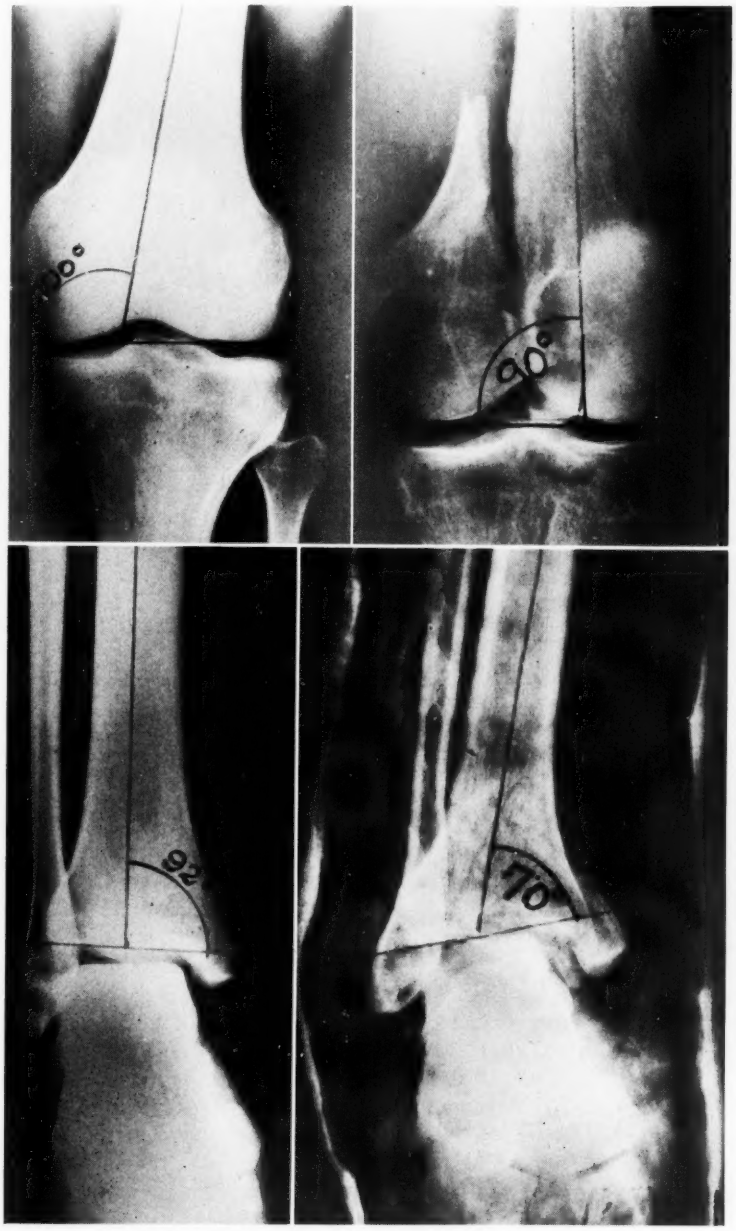

Fig. 2 (*above*). The normal medial femoral angle is 100 degrees (*left*). In fracture (*right*), the medial femoral angle is 90 degrees.

Fig. 3 (*below*). The normal medial tibial angle is 92 degrees. In fracture (*right*), the medial tibial angle has been reduced to 70 degrees.

In arriving at normals, 50 cases each of wrists, knees, and ankles were selected at random, and the angle made by the plane of the joint surface with the longitudinal diameter of the shaft of the bone was measured. In Table I the maximum, the minimum, and the average measurements are given.

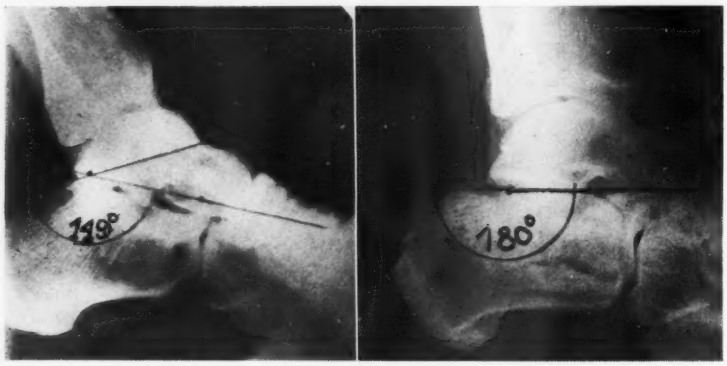

Fig. 4. The normal superior calcaneal angle (*left*) is 149 degrees. In fracture (*right*), the superior calcaneal angle is increased to 180 degrees.

1. *The Wrist Joint.*—In the anteroposterior roentgenogram a line drawn from the tip of the styloid process of the radius to the medial margin of the joint surface makes a maximum angle of 120 degrees, a minimum angle of 105 degrees, and an average angle of 110 degrees, with a line drawn through the long diameter of the shaft of the radius. This angle is measured on the lateral radial surface and I have called it the "lateral radial angle." In fracture, this angle is usually diminished (Fig. 1-*A*).

In the lateral position a line drawn through the plane of the joint surface of the radius makes a maximum angle of 110 degrees, a minimum angle of 95 degrees, and an average angle of 103 degrees, with the long diameter of the bone. This angle is measured on the dorsal surface and I have called it the "dorsal radial angle." In fracture, this angle is usually diminished (Fig. 1-*B*).

2. *The Knee Joint.*—In the anteroposterior position, a line drawn through the surfaces of the condyles makes a maximum angle of 115 degrees, a minimum angle of 95 degrees, and an average angle of 100 degrees, with the long diameter of the femur. This angle is measured on the medial surface of the femur and I have called it the "medial femoral angle." This angle is usually increased in fracture of the femur near the knee joint, but may be diminished (Fig. 2).

3. *The Ankle Joint.*—In the anteroposterior position a line drawn through the plane of the articular surface of the tibia makes a maximum angle of 95 degrees, a minimum angle of 90 degrees, and an average angle of 92 degrees, with the long diameter of the shaft of the tibia. This angle is measured on the medial surface of the tibia and I have called it the "medial tibial angle." This angle is usually increased in fracture but may be diminished near the ankle joint (Fig. 3).

4. *The Os Calcis.*—The angle formed by a line drawn from the superior margin of the anterior articular surface of the os calcis to the posterior margin of the posterior superior articular surface to the upper margin of the posterior surface forms an average angle of 149 degrees. The maximum angle is 158 degrees; the minimum, 135 degrees. This I have called the "superior calcaneal angle." It is usually increased in fracture of the os calcis (Fig.

4). Böhler prefers to use the complement of this angle which he calls the "sentinel" angle.

When the fracture occurs in the shaft of the long bone some distance from the joint surface, the terms of slight, moderate, or marked bowing or angulation of the fragments are frequently used to describe the alignment. A convenient and accurate

TABLE I.—THE SUMMARY OF 50 CASES EACH OF WRISTS, KNEES, AND ANKLES SHOWING ANGLE OF JOINT SURFACES

	Maximum	Minimum	Average
Lateral Radial Angle	120°	105°	110°
Dorsal Radial Angle	110°	95°	103°
Medial Femoral Angle	115°	95°	100°
Medial Tibial Angle	95°	90°	92°
Superior Calcaneal Angle	158°	135°	149°

method is to consider the proximal fragment as the fixed one and measure in degrees the deviation of the line of the main distal fragment from the line of the proximal fragment. For example, in Figure 5 there is a lateral deviation of the main distal fragments of the tibia and fibula of about 15 degrees.

A clear, celluloid protractor scale is preferable for making these measurements. Or, one may draw a protractor scale on the glass of the viewing box, lay the film over the scale and read the angulation directly. I have also designed a folding celluloid rule, with a protractor scale at the end, which is both useful and practical for determining the deformity accompanying fracture.

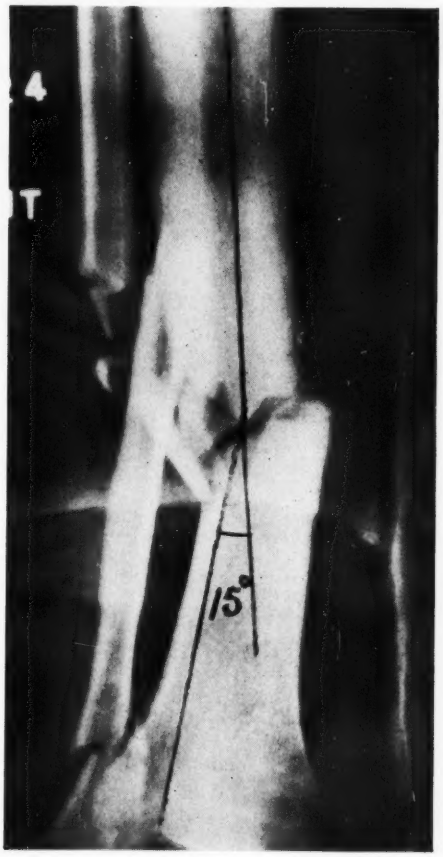

Fig. 5. In describing the alignment, there is a 15-degree lateral deviation of the main distal fragment of the tibia.

SUMMARY

1. The normal relationship of the joint surfaces of the knee, ankle, and wrist have been given.

2. The usual deformity accompanying fracture has been described.

3. A system of measurement for describing accurately the deformity accompanying fracture has been outlined.

ON THE WITNESS STAND[1]

By I. S. TROSTLER, M.D., F.A.C.R., F.A.C.P., *Chicago*

A CONSIDERABLE portion of the men who appear in our courts as expert witnesses represent neither the standing and character of the medical profession nor do they have the ability and knowledge to represent properly and efficiently the medical profession as experts on medical subjects for which they appear.

This is about as evident as anything can be and it is deplorable that this statement must be made and that it cannot be disputed. The reason for the existence of this condition is mainly due to the unwillingness of many of the more prominent and really qualified members of the medical profession to appear as witnesses. It is a fact that many of these men refuse to appear as expert witnesses, even though they are importuned to do so by the highest type of attorneys and in the furtherance of justice. One such physician, who stands high in the profession, with whom the writer, together with a highly esteemed attorney, pleaded for an hour to appear on the witness stand, refused and gave as his only excuse, "I have never appeared as an expert witness and I am not going to begin now."

In court, an expert witness must commit himself to a definite opinion and, when such a commitment has been made, he must be prepared to defend that opinion against the attacks of the opposing lawyers. The efforts of opposing experienced cross-examiners to upset the equanimity of the witness, to cause him to modify his opinion or at least to state his opinion in somewhat, or even slightly, different language, is well known. If these efforts are successful, the attorney avidly grasps the opportunity of appearing to understand that the witness had contradicted himself or at least modified his original opinion or statement. Consequently, if the witness thus assailed is at all inclined to be self-assertive, he is liable to evince sufficient personal irritation to lose much of the good impression his original opinion created, whereas if he maintains an even temper and is unperturbed by the irritating tactics of the cross-examining attorney, the good impression of honesty of purpose, clearheadedness, and earnest testimony will stand out as it should.

Sir James Fitzjames, in discussing "Trial by Jury and the Evidence of Experts," before the Judicial Society of London, in 1860, said:

> "Few spectacles, it might be said, can be more absurd and incongruous than that of a jury composed of twelve persons who, without any previous scientific knowledge or training, are suddenly called upon to adjudicate in controversies in which the most eminent scientific men flatly contradict each other's assertions. How, it might be asked, can ordinary tradesmen and farmers, who have never been accustomed to give sustained attention to any subject whatsoever for an hour together, be expected to weigh evidence, the delivery of which occupies many days, and which bears upon subjects which can only be described in language altogether new and foreign to their understanding? The conclusion usually drawn from such consideration is that some modification ought to be introduced into our present system, if not with regard to its fundamental principle, at least with respect to scientific evidence, and that we ought to take security that when scientific questions are involved in a criminal trial, the verdicts upon which the courts of justice pronounce judgment, should represent the settled opinions of the men who have made a special study of the subject, and not the loose impressions of unscientific jurors."

While the foregoing was written 80 years ago, it is well known that every word of it still holds true to-day, not only in regard to criminal trials and suits, but also regarding civil litigation.

The writer's good friend, the late Dr. Edward P. Sloan, wrote in the *Si-De-Ka Quarterly*, in April, 1923, as follows:

[1] Accepted for publication in April, 1940.

"It is needless to say that any diagnostician can make a diagnosis with more certainty when aided by his familiar assistants. Only by having the patient in a favorable environment and under such conditions that are favorable to good work, and with sufficient assistance, can any diagnostician whose sincere object is to arrive at the actual facts, make a diagnosis and give an opinion in regard to mental and physical states in obscure and disputed cases that is worthy of confidence or that should be given a place in any proper legal proceeding. Without a correct diagnosis, the medical expert is a false witness.

"But, it is unfortunately true that under present conditions in American courts, these conditions of securing correct and impartial judgment by the medical expert witness are sadly lacking; approaching the subject from the partisan standpoint, with a necessarily biassed mind which the medical expert witness must do, procludes the formation of a correct judicial opinion."

The presentation of medical expert testimony under the present American system is usually hedged about with technicalities of legal procedure which prove irksome to the average intelligent physician, whose honest desire is to present his opinion in an unbiassed manner and then proceed with his professional duties.

Of such most objectionable technicalities is the hypothetical question that is usually the most annoying to the medical man who appears as a witness. This has frequently been the target of most uncomplimentary adjectives and comments by physicians.

Cross-examination of expert witnesses affords admirable opportunity for argumentation and dialectic discussion of abstruse questions, and for the matching of wits between the attorneys and the expert witnesses; but as a method for casting the light of science upon the matter under trial in court, it is far from being perfect.

Under the usual court procedures, litigants call physicians as medical expert witnesses whose testimony is more or less limited to answering hypothetical questions, which assume the truth of the facts; but which, of course, contain such facts as the propounder of the questions considers to be favorable to the side introducing the questions. In fact, it is well known that these questions often contain assumptions which are controversial or only partly true.

The writer has repeatedly been asked such questions and a categorical reply demanded. "Answer yes or no" has been demanded when such answer was impossible and when no one could honestly make such answer. This situation has occurred to me several times and in such a manner that I have had to refuse bluntly to answer. Of course the attorney asking the question immediately applied to the presiding judge to require me to answer, and when I have been threatened with contempt of court proceedings because of refusal to answer "yes or no," I have fallen back upon the excuse that answering the question "yes or no" would involve me in perjury, which, of course, the court could not and did not require.

Medical witnesses are frequently misquoted and misrepresented. Some of this misquotation and misrepresentation may be unintentional, but my impression is that nearly all of it is intentional and so aimed as to be available to embarrass the witness later. One such unintentional instance occurred, recently, when in my testimony I referred to the *abdomen* and was interrupted by the presiding judge casually and learnedly (?) interpolating to the jury, "The Doctor means the stomach." I ceased talking, and, when the judge had finished, I, in no uncertain accent, stressed the fact that I meant *abdomen* and not *stomach*, at the same time explaining that the stomach was only one of the many organs within the abdomen. This incident occurred during re-direct examination and fortunately the attorney who was questioning me knew the difference between the stomach and the abdomen and brought this difference out by subsequent questions.

So as to produce the maximum amount of good effect in a malpractice (or any other) suit, the expert witness should be positive in his statements in reply to questions. In these trials the question generally at issue is, whether or not the de-

fendant physicians exercised the degree of skill and care usually possessed and exercised by physicians in that locality.

This is usually judged by the standard of general practitioners, unless the defendant is a specialist, and it is of no importance whether the witness would have used different methods of treatment. The question at issue is whether or not the treatment of the defendant physician was such as was considered to be good practice in that community and at the time it was administered. Minor differences regarding favorite or other remedies or methods *must not enter into the consideration of the matter at issue*, and the witness must remember that there are generally several methods of reaching the same result. Therefore, he should, if he can, state in a forcible and unequivocal manner that the method applied by his colleague and confrere (the defendant) was correct. *Say it and mean it*, and let all who hear know that it is your opinion. Do not hedge or sidestep.

Witnesses in malpractice suits should not make the grave mistake of giving out the impression that they might have been instrumental in producing a better end-result. This would give the opposition a chance to attack them in cross-examination. All of us know that there are several ways to produce certain effects and results. This is because medicine is not an exact science but is progressive, moving forward a little every day. New drugs, means, and methods; new remedies are introduced frequently and your next door neighbor may be using a method which, while radically different from yours, may be as good and may produce the identical end-result.

This difference in methods and means is particularly true in surgery and in radiology. The defendant in a suit in which you are involved may have used a different filter and voltage than you would have selected; but if the filter and voltage used matched up and delivered the dosage needed, *do not quibble but say it was adequate.*

Again, the witness might have used a cast in a case in which the defendant would have used a splint, but if the effect resulted in proper mobilization do not dispute the facts. Say that it would do what was needed. Say it forcibly enough that all who hear you know that you mean it. Say it and stick to it. Understand me, I do not mean that you should shout; but say it distinctly, clearly, and look at the jury when saying it.

Perjury by expert witnesses is alarmingly frequent, but because it is so difficult to prove, prosecution is seldom undertaken. It is well that this is so because opinions may differ and much of our expert testimony is opinion testimony. The usual conception of perjury is a false statement of fact; but it is not perjury for a witness to testify regarding his opinion, if he be honest in that opinion, no matter how wrong that opinion may be. He may be color blind and say that blue is yellow, and not be guilty of perjury, even though the true state of affairs is patent to everyone else.

Differences of opinion, even though they may be honest, are frequently attributed by the bar and the laity to bias and to frank venality, but we must believe that instances are rare in regard to the latter. It must be admitted that bias exists in every one, to a greater or lesser degree, consequently those who criticize an expert witness most loudly should "hesitate before they cast the first stone" in this regard.

For no very good reason many persons suspect the integrity of expert witnesses who do not agree, forgetting entirely the everyday examples of differences of opinion expressed by honest men in every walk of life, from Justices of our Supreme Courts down to the residents of our slums. As a matter of fact, many of these differences of opinion of expert witnesses are often more apparent than real, thanks mainly to the refusal of opposing attorneys to permit witnesses to explain their views and the reasons therefor, and other peculiarities of court room procedures.

On the other hand, perjury is prevalent in the prosecution of nearly all personal injury suits. In a recent case, in which the writer appeared for the defense, the widow and two children of a deceased claimant testified emphatically and at length that the deceased had always been in good health; but they were dumbfounded when the defense produced and presented hospital records which showed that he had been an inmate of an hospital for more than six months and that his widow had sworn to a complaint that he was a menace to his family and the public, etc. This resulted, of course, in the case being thrown out of court; but if the insurance company had been less alert in their investigations, there would have been a liberal verdict given for the perjurers.

A dentist in a West Coast State was sued for allegedly poisoning a patient by using arsenic in a root canal filling, the alleged "arsenical poisoning" having been discovered some six years later, when the tooth was x-rayed and removed. An expert witness for the plaintiff qualified as an oral surgeon and testified that x-ray films which he had made clearly showed fibers of cotton in the dental filling, while in another breath this same expert testified that the root canals were not filled. The tooth in question was broken open at the trial and the root canals were shown to be filled and no cotton fibers were found. The defendant was thus proven to be truthful and the plaintiff's expert witness was exposed. However, despite this situation the court forced a settlement by saying that he would grant a judgment for the plaintiff if no amicable adjustment could be arrived at.

Numerous examples of similar conduct (or misconduct) could be produced if necessary.

In a previous paper in this Journal[2] I said, "As a rule, it is not advisable to become facetious" when on the witness stand; but I have found that there are occasions when fearless facetiousness facilitates truth. One such occasion was as follows: I was in court as an expert witness. During direct examination I testified that certain roentgenograms which had been handed me for interpretation showed "a normal pelvis of an adult female." The plaintiff's attorney had cross-examined me in a most thorough manner, demanding, in various ways, to know why I insisted that the films showed a normal pelvis. Finally, he said, "I am not satisfied with your answers that it was because of your 36 years in the practice of medicine and that in that time you have examined a large number of female human pelves. I want you to tell this Court and jury exactly why you said that that pelvis was normal." I replied, "Mr. B., I say that the pelvis shown in plaintiff's exhibits *A*, *B*, and *C* is normal for the same reason that I say that your neck is dirty—because I can see it." The jury laughed, the judge rapped for order, and Mr. B., disconcerted and apparently satisfied, said, "That is all, Doctor."

[2] The Medical Expert Witness. RADIOLOGY, **17**, 807, October, 1931.

CASE REPORT

A CASE OF FUSION OF THE THIRD AND FOURTH LUMBAR VERTEBRÆ[1]

By HENRY G. HADLEY, M.D., *Washington, D. C.*

Donaldson (1), in listing ten congenital abnormalities, gives the three most rare as (*a*) intercalation of a whole or portion of a vertebra, (*b*) non-development of one side of the centrum, (*c*) fusion of two vertebræ without formation of a disc.

Evans (2) stated that the majority of anomalies of the vertebræ were those of intercalation as a result of imperfect segmentation in the ossification centers. From this there may be a block vertebra, due to the absence of intervertebral discs, which are more often at the cervical level. There may be a fusion of two bodies unilaterally, or complete, or there may be cross-fusion.

Wise (3) reported a case in which the bodies of the vertebræ were tilted and the third lumbar vertebra on the right was united to the fourth on the left. He stated that there were two centers of chondrifications in each body and one in each half of the arch. At the eighth week of the embryo ossification begins in a single center in the body and in each half of the arch.

[1] Accepted for publication in August, 1939.

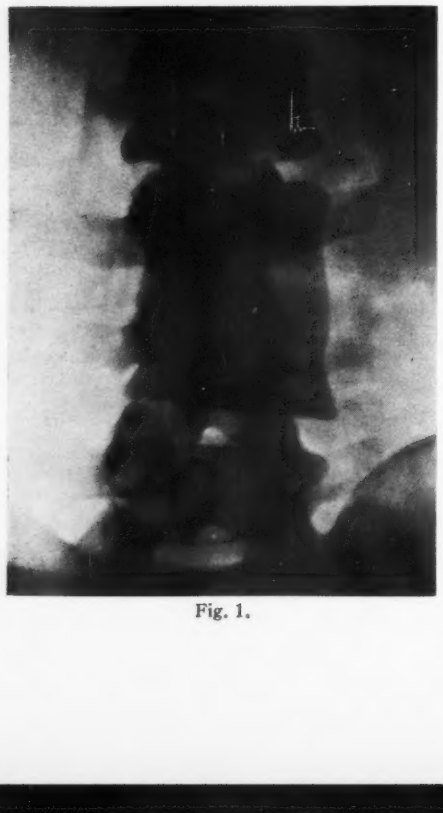

Fig. 1.

That these abnormalities are not frequent is shown by Willis' study of 1,400 skeletons, in which he found the abnormalities to be confined to the lumbosacral area (4).

In the embryo the first anlage of the spine is a longitudinal column of ectodermal cells called the notochord, which forms beneath the neural groove. Paralleling this notochord are longitudinal groups of mesodermal cells and paraxial mesoblasts. These two paraxial masses undergo segmentations, producing 37 somites. These somites become sclerotomes which grow toward each other around the notochord. The sclerotomes divide into two parts, the less dense cranial portion becoming the anlage of the intervertebral disc and the more dense caudal portion the sclerомere or primitive vertebral body. The sclerомeres become transformed into dense cartilage, there being at first two centers of chondrification (5).

In the newborn the vertebral body shows three zones of osseus tissue: a middle transverse zone of lessened density which forms cancellous bone and two layers, one superior and one inferior, which are more dense and represent ossifying cartilage. The central, more vascular layer has large canals for blood vessels which are evident on the roentgenograms of all infants and which may persist to adult life. The central layer is smaller than the others, giving the appearance of a depression when observed in profile. The center for the anterior portion of the body unites with the posterior at about the fifth or sixth year. Secondary centers of ossification or epiphyses appear in the chondral superior and inferior portions of the discs between the sixth and seventeenth years and complete fusion of these centers with the main body occurs at about the twentieth year of life.

Report of Case.—G. T., 39-year-old male, complained of a severe pain in the back for eight months, which had gradually increased during the last two weeks. An x-ray examination made on Oct. 30, 1938, showed fusion of the lamina of the third and fourth intervertebral changes.

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THE RADIOLOGICAL CONSULTANT[1]

On the introduction of roentgen rays the problems were chiefly physical, and medical application resulted from collaboration between the physicist and the physician. As demands on the diagnostic and therapeutic use increased and broadened, it became necessary that some of those physicians particularly interested devote their time entirely to the medical application of x-rays and radio-active substances. This marked the first forward step in the establishment of a specialty.

Under the Medical Practice Act any physician may make roentgenographic examinations and administer therapeutic radiation. He may do this in connection with his other practice or limit himself entirely.

By definition, a radiologist must necessarily have completed the prescribed course of study leading to the degree of Doctor of Medicine and have pursued special post-graduate study in radiology.

In the practice of radiology it is necessary to apply the same code of ethics and the same general practices as are recognized in other branches of medicine. These principles involve both professional and economic subjects, as any physician is judged by his business methods as well as by his professional qualifications.

However, the specialist, be he gynecologist, surgeon, or radiologist, in order to justify his existence as such, must perform the acts connected with that specialty more efficiently than any other physician. Without this particular ability there is no reason for his medical existence as a specialist.

The fact that many physicians consider the radiologist as a mere technician who "takes pictures" is unfortunate and yet true. The practitioner is frequently not at fault in this belief as his contact may be with the so-called radiologist who does just that. Those radiologists who are worthy of the name will give such good consultation as to convince their fellow physician that they are able consultants and can be of great assistance to both them and their patients. The "technician type," valueless as consultants, will fall by the wayside, as will any other medical incompetent.

A major basis for the unfortunate relegation of the radiologist to the occupation of photographer is the situation in many hospitals where the radiologist is made a salaried employee. This causes the visiting staff to regard him as a servant procured by the hospital to carry out their orders, rather than a medical consultant available to them.

A second reason for this unfortunate classification of the radiologist arises from the practice of some who make their work subservient to adopted fee schedules. A set fee schedule can no more be practised in radiology than in any other branch of medicine. The radiologist is not selling cellulose acetate by the square inch. Charges must be based on the amount of time and study required and related to the financial status of the patient. A minimum fee schedule is just as impractical as a maximum schedule. The sincere radiologist is honest and scientifically interested and will be fair in his estimate of fees. He, however, deplores any act of the referring physician which would seem to limit the scope or dictate the methods to be followed in his examination. A physician should refer a patient to a radiologist for consultation as regards a certain medical question and allow the radiologist to follow such procedures as, in his opinion, may be indicated.

Education of the laity is important. Education meaning that there should be sufficient information disseminated to keep constantly before patients as well as physicians the fact that radiologists make examinations and do not take "pictures"; that radiologists administer therapeutic irradiation and do not have "sittings."

How frequently does the radiologist receive a 'phone inquiry: "Doctor, how much is an x-ray?" Such an erroneous attitude is largely the fault of radiology and not of the inquiring person. So much effort has been directed toward scientific and technical advance that the necessity of keeping the profession and the

[1] Presented by the Chairman of the Section on Radiology, California Medical Association, at Pasadena, May, 1938.

lay population informed as to the status and practice of radiology has been neglected.

It is necessary always to explain in detail that the patient is not paying a fee for a certain amount of cellulose. He must understand that he has come to the radiologist for an examination, a consultation, and an opinion. Too much time and effort cannot be expended in explanation of these points to patients. Frequent presentation of this subject in medical conference is much in order lest it be lost sight of within the profession.

What should be the relation of the radiologist to the patient, and what should be the relation to the physician? These questions cannot be discussed separately, as they are overlapping and consideration of one necessitates coördination with the other.

In the first place, the radiologist is primarily a consultant. The patient referred to him should be referred by the original physician for the purpose of diagnosis or treatment, as the case may be. During the time that patient is being observed by the radiologist, his actions should be those of any other consultant.

He should first obtain such history and physical examination as is necessary. Second, he should direct and supervise the taking of such roentgenograms as will assist him, and the referring physician, in arriving at a diagnosis. Third, he should consider a request of the referring physician for specific types of x-ray exposures or projections as a suggestion and not an order. Fourth, he should not discuss with the patient his opinion or his findings any more than a medical consultant would give his opinion to a patient on whom he was consulting with a surgeon. After the two opinions have been properly coördinated, and then only on the request of the referring physician, the radiologist may express himself to the patient. Finally, the radiologist should be certain that the patient is returned to his original physician, having avoided any suggestion or criticism which would instill doubt in the mind of the patient as to the procedures previously adopted.

In the case of patients referred for radiotherapeutic applications, a somewhat different procedure must necessarily be followed. During the period of therapeusis, the patient must be considered as the patient of the radiologist. Reports at intervals to the referring physician are in good taste and should be given fully when requested. However, the patient is in the care of only the radiologist insofar as that immediate condition is concerned and any new or dissociated disability requires that the patient be returned to the original physician for its treatment.

One source of difficulty and misunderstanding lies in the type of consultation in which a written report is rendered and there is no contact or discussion between the consultants. Many of these reports are no more than a technician's description of a series of roentgenograms. Discussion of shadows, haziness, increased and decreased density is had but no conclusion or diagnosis is included in the report. This is of little, if any, assistance to the referring physician. It is analogous to the internist who is asked to see a surgical patient in consultation and, after a very careful, detailed examination, precisely enumerates the temperature, pulse, respiration, symptoms, and signs in a long report to the referring physician. Certainly a discussion and conclusion must be had.

The question frequently arises as to the radiologist's position in examination and treatment of patients who are not referred by other physicians but come to him of their own volition. Can the radiologist, who must have in addition to his specialized training a good knowledge of diagnostic medicine, say to the patient: "I am not capable of making this examination; you must see some other doctor"? Or should the radiologist make such examinations as seem advisable and, after arriving at a diagnosis, refer that patient to the physician he feels best suited to follow out the necessary therapeutic measures?

The radiologist is bound by the same code as any other specialist. Many consultants in all branches of medicine prefer to accept only referred cases. Thus he may feel free to refer the case for examination or may examine the patient himself as suits his preference. If he feels that it is in the interest of the patient to have other examinations, it is no admission of lack of ability for him to refer the patient elsewhere. The calling of one radiologist in consultation by another would add materially to the standing of these men and the specialty.

How about the examination of patients who have been under the care of practitioners of various cults? Are these persons to be told that a radiologic examination cannot be made or treatment administered because they have been seen by some practitioner not recognized?

The radiologist or any other medical man cannot formally consult with unrecognized cult practitioners. The patient, however, is entirely within his rights to have an examination by some radiologic procedure by the same token as was discussed in the preceding paragraph. These findings should be given to the patient together with proper advice as to what procedures should be adopted. To tell the patient: "I cannot see you, you are unclean," merely assists in establishing the irregular practitioner and prevents the patient from receiving such assistance as he needs without accomplishing one single good end. The request for the examination must come from the patient and it must be known that there will be no consultation with the cultist. The results of the examination must also be given to the patient or to some regular physician selected.

Frequently the radiologist receives a consultation request from a physician who requests a certain examination. After a discussion with the patient as to symptoms and physical findings it appears that the examination requested is unwarranted and that either a different type of examination, or none at all, is advisable. This must be discussed with the referring physician who will thank the radiologist for his interest.

Much harm has been done by irrational and ill advised radiotherapeutic measures. Not so much harm to the patient but harm to the specialty. Especially is this true of useless and unnecessary publicity in the newspapers of certain procedures which are still in the experimental stage.

While it is true that tonsils can be divested of their lymphoid tissue and in a large majority of the cases caused to become innocent structures, a patient requesting radiotherapy for chronic tonsillitis should be told that surgery is ordinarily the best method of procedure. Unless there is some reason that surgery should not be done, treatment should not be given. Similarly, the treatment of chronic sinusitis within the last few years has received much publicity and all radiologists have been approached by sinusitis victims with requests for therapy. If all these patients are treated, radiology will be justly criticized, as many of them are not amenable to radiotherapy.

If radiologists are to obtain the support and respect of the medical practitioner, they must do so by a demonstration of ability and fortitude. Mistakes in interpretation will be made and the well deserved caustic comments of the referring physician received. But behind it all will be recognized the sincere effort to assist, and it is quite possible that the referring physician will, without too great an effort, recollect some error he has made.

Each step taken in the daily routine of a radiologist is important not only to him but to the entire branch with which he is affiliated. Careless work, careless acts, and careless words will only prevent him and his associates from occupying their proper place in medical consultation.

JOHN D. LAWSON, M.D.

RADIOLOGICAL SOCIETIES IN NORTH AMERICA

Editor's Note.—Will secretaries of societies please cooperate with the Editor by supplying him with information for this section? Please send such information to Leon J. Menville, M.D., 1201 Maison Blanche Bldg., New Orleans, La.

UNITED STATES

CALIFORNIA

California Medical Association, Section on Radiology.—Chairman, Carl H. Parker, M.D., 65 N. Madison Ave., Pasadena; *Secretary,* Wilbur Bailey, M.D., 2007 Wilshire Blvd., Los Angeles.

Los Angeles County Medical Association, Radiological Section.—President, M. L. Pindell, M.D.; *Vice-president,* Richard T. Taylor, M.D.; *Secretary,* Wilbur Bailey, M.D., 2007 Wilshire Blvd.; *Treasurer,* Henry Snure, M.D., 1414 South Hope Street; Kenneth Davis, M.D., *Member of Executive Committee.* Meets second Wednesday of each month at County Society Building.

Pacific Roentgen Society.—Chairman, William E. Costolow, M.D., Los Angeles; *Members of Executive Committee,* I. S. Ingber, M.D., San Francisco; D. R. MacColl, M.D., Los Angeles, and J. D. Coate, M.D., Oakland; *Secretary-Treasurer,* L. Henry Garland, M.D., 450 Sutter St., San Francisco. Executive Committee meets quarterly; Society meets annually during annual meeting of the California Medical Association.

San Francisco Radiological Society.—Secretary, Harold A. Hill, M.D., 450 Sutter Street. Meets monthly on third Thursday at 7:45 P.M., for the first six months at Toland Hall (Univ. of Calif. Med. School) and for the second six months at Lane Hall (Stanford Univ. School of Med.).

COLORADO

Denver Radiological Club.—President, N. B. Newcomer, M.D., 306 Republic Bldg.; *Vice-president,* Elizabeth Newcomer, M.D.; *Secretary,* Paul R. Weeks, M.D., 520 Republic Bldg.; *Treasurer,* L. G. Crosby, M.D., 366 Metropolitan Bldg. Meets third Friday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Chairman, Owen J. Groark, M.D., 881 Lafayette St., Bridgeport; *Secretary-Treasurer,* Max Climan, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

Affiliated with Philadelphia Roentgen Ray Society.

FLORIDA

Florida Radiological Society.—President, J. H. Lucinian, M.D.; *Vice-president,* John N. Moore, M.D.; *Secretary-Treasurer,* Elliott M. Hendricks, M.D., 314 Sweet Bldg., Fort Lauderdale. The next meeting will be at the time of the annual meeting of the Medical Association of Florida in the spring.

GEORGIA

Georgia Radiological Society.—President, Robert Drane, M.D., DeRenne Apts., Savannah; *Vice-president,* J. J. Collins, M.D., Archbold Hospital, Thomasville; *Secretary-Treasurer,* Robert C. Pendergrass, M.D., Prather Clinic Bldg., Americus. Meetings twice annually, in November and at the annual meeting of the Medical Association of Georgia in the spring.

ILLINOIS

Chicago Roentgen Society.—President, Adolph Hartung, M.D.; *Vice-president,* Warren W. Furey, M.D.; *Secretary,* Chester J. Challenger, M.D., 3117 Logan Blvd. The Society meets at the Palmer House on the second Thursday of October, November, January, February, March, and April.

Illinois Radiological Society.—President, Harry W. Ackeman, M.D., 321 W. State St., Rockford; *Vice-president,* D. R. Hanley, M.D., St. Mary's Hospital, Streator; *Secretary-Treasurer,* William DeHollander, M.D., St. John's Hospital, Springfield. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—Chairman, Harry W. Ackeman, M.D., 321 W. State St., Rockford; *Secretary,* Earl E. Barth, M.D., 303 E. Chicago Ave., Chicago.

INDIANA

The Indiana Roentgen Society.—President, H. H. Inlow, M.D., Shelbyville; *President-elect,* Charles Wyeth, M.D., Terre Haute; *Vice-president,* C. A. Stayton, M.D., Indianapolis; *Secretary-Treasurer,* Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

KENTUCKY

Kentucky Radiological Society.—President, D. B. Harding, M.D., Lexington; *Vice-president,* I. T. Fugate, M.D., Louisville; *Secretary-Treasurer,* Joseph C. Bell, M.D., 402 Heyburn Bldg., Louisville. Meeting annually in Louisville, third Sunday afternoon in April.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Chairman, John W. Pierson, M.D., 1107 St. Paul St.; *Secretary*, Walter L. Kilby, M.D., 101 W. Read St. Meetings are held the third Tuesday of each month.

The Thirty-first Annual Midwinter Conference of Eastern Radiologists will meet in Baltimore on Jan. 31 and Feb. 1, 1941.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

Detroit X-ray and Radium Society.—President, O. J. Shore, M.D., 552 Fisher Bldg., Detroit; *Vice-president*, Clarence E. Hufford, M.D., 421 Michigan St., Toledo, Ohio; *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave., Detroit.

Michigan Association of Roentgenologists.—President, J. H. Dempster, M.D., Detroit; *Vice-president*, L. E. Holly, M.D., Muskegon; *Secretary-Treasurer*, J. E. Lofstrom, M.D., 1536 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—President, Harry Weber, M.D., Mayo Clinic, Rochester; *Vice-president*, G. T. Nordin, M.D., Minneapolis; *Secretary*, John P. Medelman, M.D., 572 Lowry Medical Arts Bldg., St. Paul. Meetings quarterly.

MISSOURI

The Kansas City Radiological Society.—President, Galen M. Tice, M.D., Univ. of Kansas Hospitals, Kansas City, Kansas; *Secretary*, P. E. Hiebert, M.D., 907 North Seventh St. (Huron Bldg.), Kansas City, Kansas. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—President, Oscar C. Zink, M.D., St. Luke's Hospital; *Secretary*, Wilbur K. Mueller, M.D., University Club Bldg. Meets on fourth Wednesday of October, January, March, and May, at a place designated by the president

NEBRASKA

Nebraska Radiological Society.—President, H. A. Scott, M.D., Veterans Administration Facility, Lincoln; *Secretary*, D. A. Dowell, M.D., 816 Medical Arts Bldg., Omaha. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *Secretary*, Hugh F. Hare, M.D., Lahey Clinic, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—President, James G. Boyes, M.D., 912 Prospect Ave., Plainfield; *Vice-president*, Nathan J. Furst, M.D., 190 Johnson Ave., Newark; *Secretary*, W. James Marquis, M.D., 198 Clinton Ave., Newark; *Treasurer*, H. A. Vogel, M.D., 1060 East Jersey St., Elizabeth, and *Counsellor*, H. J. Perlberg, M.D., 921 Bergen Ave., Jersey City. Meetings at Atlantic City at time of State Medical Society and Midwinter in Newark as called by president.

NEW YORK

Associated Radiologists of New York, Inc.—President, I. J. Landsman, M.D., 910 Grand Concourse, New York City; *President-elect*, D. E. Ehrlich, M.D., 35 West 92nd St., New York City; *Vice-president*, Frederic E. Elliott, M.D., 122 76th St., Brooklyn; *Treasurer*, Solomon Fineman, M.D., 133 East 58th St., New York City; *Secretary*, William J. Francis, M.D., 210 Fifth Ave., New York City. Regular meetings the first Monday evening of the month in March, May, October, and December.

Brooklyn Roentgen Ray Society.—President, A. L. L. Bell, M.D., Long Island College Hospital, Henry, Pacific, and Amity Sts.; *Secretary-Treasurer*, L. J. Taormina, M.D., 1093 Gates Ave. Meetings held the fourth Tuesday of every month, October to April.

Buffalo Radiological Society.—President, Edward Koenig, M.D., 100 High St., Buffalo; *Vice-president*, W. Roger Scott, M.D., 598 Pine St., Niagara Falls; *Secretary-Treasurer*, Joseph S. Gian-Franceschi, M.D., 610 Niagara St. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen Ray Society.—President, Albert Lenz, M.D., 613 State St., Schenectady; *Vice-president*, Dwight V. Needham, M.D., 123 Sedgwick St., Syracuse; *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings are held in January, May, and October, as called by Executive Committee.

Long Island Radiological Society.—President, Samuel G. Schenck, M.D., Brooklyn; *Vice-president*, G. Henry Koiransky, M.D., Long Island City; *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn; *Treasurer*, Louis Goldfarb, M.D., 608 Ocean Ave., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—President, Henry K. Taylor, M.D., 667 Madison Ave., New York City;

Vice-president, Roy D. Duckworth, M.D., 170 Maple Ave., White Plains, N. Y.; *Secretary*, Eric J. Ryan, M.D., St. Luke's Hospital, New York City, and *Treasurer*, Paul C. Swenson, M.D., 168th St. and Broadway, New York City.

Rochester Roentgen-ray Society.—Chairman, George H. S. Ramsey, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

NORTH CAROLINA

Radiological Society of North Carolina.—President, Robert P. Noble, M.D., 127 W. Hargett St., Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Ohio Radiological Society.—President, U. V. Portmann, M.D., Cleveland; *Secretary*, J. E. McCarthy, M.D., Cincinnati. A committee was appointed to draw up a constitution and by-laws. The next meeting will be held at the time and place of the annual meeting of the Ohio State Medical Association.

Cleveland Radiological Society.—President, L. A. Pomeroy, M.D., Hanna Bldg., Cleveland; *Vice-president*, P. C. Langan, M.D., 215 Wellesley Ave., Akron; *Secretary-Treasurer*, H. A. Mahrer, M.D., 10515 Carnegie Ave., Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*President*, Samuel Brown, M.D.; *Secretary-Treasurer*, Justin E. McCarthy, M.D., 707 Race St. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—President, H. Norton Mawhinney, M.D., Pittsburgh; *President-elect*, Peter B. Mulligan, M.D., Ashland; *First Vice-president*, Harold S. Callen, M.D., Bradford; *Second Vice-president*, Harold W. Jacox, M.D., Pittsburgh; *Secretary-Treasurer*, L. E. Wurster, M.D., 416 Pine St., Williamsport; *Editor*, William E. Reiley, M.D., Clearfield; *Assistant Editor*, Sydney J. Hawley, M.D., Danville; *Censor for Three Years*, A. R. Snedden, M.D., McKeesport. The Society meets annually; time and place of next meeting will be announced later.

The Philadelphia Roentgen Ray Society.—President, Jacob H. Vastine, II, M.D., Medical Arts Bldg., Philadelphia; *Vice-president*, A. Maxwell Sharpe, M.D., 708 Sproul St., Chester; *Secretary*, Barton R. Young, M.D., Temple University Hospital, Philadelphia; *Treasurer*, Fay K. Alexander, M.D., Chestnut Hill Hospital, Philadelphia. Meetings held first Thursday of each month at 8:15 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22nd St., Philadelphia.

The Pittsburgh Roentgen Society.—President, Paul G. Bovard, M.D., 306 Corbett St., Tarentum, Pa.; *Vice-president*, John H. Gemmell, M.D., 262 Connecticut Ave., Rochester, Pa., and *Secretary-Treasurer*, Harold W. Jacox, M.D., 4800 Friendship Ave., Pittsburgh, Pa. Meetings held second Wednesday of each month at 4:30 P.M., from October to June, at various hospitals designated by program committee.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—President, T. A. Pitts, M.D., Columbia; *Secretary-Treasurer*, Malcolm Mosteller, M.D., Columbia Hospital, Columbia. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee Radiological Society.—President, Eugene Abercrombie, M.D., 305 Medical Arts Bldg., Knoxville; *Vice-president*, Christopher C. McClure, M.D., 404 Doctors Bldg., Nashville; *Secretary-Treasurer*, Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—President, C. F. Crain, M.D., Corpus Christi; *President-elect*, M. H. Glover, M.D., Wichita Falls; *First Vice-president*, G. D. Carlson, M.D., Dallas; *Second Vice-president*, P. E. Wigby, M.D., Dallas; *Secretary-Treasurer*, L. W. Baird, M.D., Scott and White Hospital, Temple. Meets annually. The next annual meeting is to be Jan. 18, 1941, in Sherman.

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Virginia Radiological Society.—President, Wright Clarkson, M.D., Petersburg; *Vice-president*, Clayton

W. Ely, M.D., Norfolk; *Secretary*, Charles H. Peterson, M.D., 603 Medical Arts Bldg., Roanoke.

WASHINGTON

Washington State Radiological Society.—President, H. E. Nichols, M.D., Stimson Bldg., Seattle; *Vice-president*, George Cornett, M.D., Yakima; *Secretary-Treasurer*, Kenneth J. Holtz, M.D., American Bank Bldg., Seattle. Meetings fourth Monday of each month at College Club, Seattle.

WISCONSIN

Milwaukee Roentgen Ray Society.—President, H. W. Hefke, M.D.; *Vice-president*, Frederick C. Christensen, M.D.; *Secretary-Treasurer*, Irving I. Cowan, M.D., Mount Sinai Hospital, Milwaukee. Meets monthly on first Friday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—Secretary, Russel F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—Secretary, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301 Service Memorial Institute.

CANADA

Section on Radiology, Canadian Medical Association.—Chairman, Gordon Richards, M.D., Medical Arts Bldg., Toronto; *Secretary*, W. J. Cryderman M.D., Medical Arts Bldg., Toronto.

Section on Radiology, Ontario Medical Association.—Chairman, E. H. Shannon, M.D., St. Michael's Hospital, Toronto; *Secretary*, W. J. Cryderman, M.D., 474 Glenlake Avenue, Toronto.

Canadian Association of Radiologists.—President, J. E. Gendreau, M.D., Montreal; *Vice-president*, W. H. McGuffin, M.D., Calgary; *Honorary Secretary-Treasurer*, W. L. Ritchie M.D., Montreal; *Chairman of Interrelations Committee*, G. E. Richards, M.D., Toronto.

La Société Canadienne-Française d'Electrologie et de Radiologie Médicales held a meeting at Quebec on Sept. 28, 1940, at which time the following officers were elected for the next two years: *President*, Albert Comtois, M.D., Hôpital Ste.-Justine, Montreal; *First Vice-president*, Jules Gosselin, M.D., Hôpital St.-Sacrement, Quebec; *Second Vice-president*, Paul Brodeur, M.D., General Hospital, Ottawa; *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal, and *General Treasurer*, Doriva Léonard, M.D., Hôpital Notre Dame, Montreal. Meetings are held the third Saturday of each month, generally at the Radium Institute, 4120 East Ontario Street, Montreal; sometimes, at homes of members.

CUBA

Sociedad de Radiología y Fisioterapía de Cuba.—Offices in Hospital Mercedes, Havana. Meetings are held monthly.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor* HOWARD P. DOUB, M.D., *Associate Editor*

W. WALTER WASSON, M.D.: AN APPRECIATION

To his numerous friends in the Radiological Society of North America the election of Walter Wasson to the Presidency, at the Atlanta meeting, came as a distinct pleasure. His thorough, constructive work is well known to roentgenologists of the country, with whom he is a well liked personality.

W. Walter Wasson, M.D., President of the Radiological Society of North America for the ensuing year, is a native of Illinois and is 56 years of age. He received the degrees of B.A. and M.D. from the University of Colorado in 1908 and 1910, respectively. He practised medicine and radiology in Boulder, Colorado, from 1910 to 1916. He moved to Denver in 1916, limiting his work to radiology. He early realized that the evaluation of the shadows portrayed on the film required the understanding of anatomy, physiology, and pathology, since the body was undergoing progressive changes from birth to death. Beginning with the old gas tube, he developed the rapid technic of chest radiology and was among the first to use the film. His contributions to literature have covered a wide range of subjects, but chiefly on the roentgenologic anatomy and pathology of the chest and sinuses.

He was awarded the Gold Medal of the Radiological Society of North America in 1926 for his research in diagnosis of chest diseases in children. In 1922 he organized and founded the Selmene Winter Foundation, to study the development of the child and to try to determine the beginning of disease.

During his membership in the Radiological Society he has served on various committees; has been vice-president twice, and was Counselor for Colorado for several years. He was Chancellor of the American College of Radiology from 1923 to 1931. He was vice-president of the American College of Radiology for the term 1932–1933, and also was vice-chairman of the Section of Radiology, American Medical Association, for 1932–1933.

JOHN S. BOUSLOG, M.D.

Now that he is entering on his term as President of the Radiological Society of North America, we foresee for Dr. Wasson a further addition to the honors he has known.

The Editor wishes to add to Dr. Bouslog's words a note expressive of his personal admiration of Dr. Wasson. His great interest in our organization for these many years makes him most eminently qualified to guide the Radiological Society for the coming year. The confidence, respect, and admiration which he has created for himself with the men of this Society will assure their loyal co-operation during his administration.

REPORT OF THE ANNUAL MEETING

The members of the Radiological Society of North America who were unable to attend the Twenty-sixth Annual Meeting, held in Cleveland, Dec. 2–6, missed a real treat. Under the capable management of the President, Dr. B. H. Nichols, and his very efficient local committees, headed by Dr. E. P. McNamee, scientific and social programs were presented. There was an attendance of 772, including members, guests, and exhibitors.

Since it was started three years ago, the outstanding scientific achievement of the Society has been the series of Refresher Courses. Dr. Lewis G. Allen, who has arranged and managed these courses since their beginning, deserves great credit for their success. This

W. WALTER WASSON, M.D.
President of the Radiological Society of North America

year, Dr. Allen presented thirty-three educational courses covering various radiologic subjects. The average pre-convention enrollment was 250, but, as a matter of fact, there were 286 in the classes Sunday afternoon. The size of the group in the Courses was determined by the size of the room available. This year, mimeographed notes were furnished to each enrollee. It was also possible to obtain thirty-five millimeter film strips of illustrations used in the Courses.

The first course in the Refresher Series, Radiology of the Stomach, Duodenum, and Gall Bladder, by Dr. E. P. Pendergrass, with Dr. W. O. Abbott, Dr. J. Gershon-Cohen, Dr. I. S. Ravdin, and Dr. W. E. Chamberlain, was managed like a conference. The anatomy, physiology, pathology, surgery, and roentgenology of each part of the subject were discussed by these men. An opportunity was given the audience to enter into the discussion.

Dr. Ross Golden's course, on Radiology of the Small Intestine, was a very comprehensive study of the method of examination, review of the normal small intestine, followed by detailed study of disturbances in physiology, inflammations, and neoplasms of the small intestine. Nothing on this subject has been published as complete as this course of Dr. Golden's.

Again, nothing has been published on the Radiologic Aspects of the Arthritides which could be compared with Dr. L. H. Garland's classic presentation. It was a pure radiologic study of the subject.

Dr. John Murphy presented Sixteen Hundred Cases of Bone Tumor in a clinical, radiologic, and pathologic sequence of study. One interesting and highly instructive feature of this course was the number of cases which had been followed for some time. The diagnosis was either proven, or the error discovered, at autopsy.

An extremely interesting analysis of X-ray Therapy in the Treatment of Carcinoma of the Skin was given by one of the Deans of Radiology, Dr. James M. Martin, who presented notes, charts, photographs, and diagnoses of cases collected from many years of experience.

Dr. Karl Kornblum gave a most comprehensive course on the subject of Radiology of the Genito-urinary Tract. This course consisted of a discussion of: (1) the flat film examination of the abdomen; (2) retrograde pyelography; (3) congenital lesions; (4) intravenous or excretory urography; (5) cystography; (6) urethrography, and (7) the participation of the roentgen examination of the urinary tract in the more recent advancements of medicine.

Dr. L. R. Sante divided Radiology of the Chest into three groups: Acute Inflammatory Diseases of the Chest; Atelectasis and Conditions Associated with Partial or Complete Bronchial Occlusion, and Roentgenologic Aspects of Pulmonary Tuberculosis.

Otto Glasser, Ph.D., arranged the course on Physics of Radiation. He planned this subject so that the following physicists could take part in the symposium: Production of X-rays, R. R. Newell, M.D.; Production of Supervoltage X-rays, L. S. Taylor, Ph.D.; Structure of Matter, Otto Glasser, Ph.D.; Radio-activity, Natural and Induced, K. W. Stenstrom, Ph.D.; Characteristics of X-rays and Radium Rays, J. L. Weatherwax, M.A.; Specification of X-ray and Gamma-ray Doses in Roentgens, E. H. Quimby, Sc.D.; Use of Artificially Radio-active Substances in Medicine and Biology, K. E. Corrigan, Ph.D.; Practical Use of Geiger Counters in Radiology, L. Rovner, M.A.; Biologic Aspects of Clinical Effects of X-rays, P. S. Henshaw, Ph.D.

A new subject, Dental Radiology, was added to the ones previously presented in the Refresher Courses. C. A. Resch, D.D.S., of Cleveland, covered this subject by discussing Anatomic Landmarks of the Jaws; Limitations of Dental Radiology; Inflammatory Conditions; Dental Anomalies; Other Considerations of Dental Interest, and Technic Considerations.

Arduous preparation and painstaking care were used in the arrangement of the Refresher Courses. It would be impossible to give a detailed description of each course. Radiology of the Esophagus was given by Dr. John T. Farrell, Jr.; Radiology of the Colon, by Dr. E. L. Jenkinson; Kymography, by Dr. Wendell G. Scott; Roentgen Analysis of Fractures, by Dr. W. E. Chamberlain; Cardioradiology, by Dr. Samuel Brown; Silicosis, by Dr. W. M. Doughty; Radiology of the Skull, by Dr. M. C. Sosman; Contrast Myelography, by Dr. John D. Camp; Encephalography, by Dr. Cornelius G. Dyke; Radiology of Sinuses and Mastoids, by Dr. G. W. Grier; Bone Diseases of Children, by Dr. Leo G. Rigler; Radiation Therapy of the Lymphoblastomas, by Dr. B. P. Widmann; Fundamental Principles of Protracted Fractionated Irradiation, by Dr. Milton Friedman; Radiation Therapy of In-

flammatory Disease, by Dr. Ira I. Kaplan; Radiation Therapy of Cancer of the Breast, by Dr. U. V. Portmann; Radiation Therapy of Carcinoma of the Cervix, by Dr. Edwin C. Ernst.

The Film-reading Sessions Sunday evening were exceptionally well attended. In one room Dr. Ross Golden and Dr. Merrill Sosman took charge, while in another, Dr. W. E. Chamberlain and Dr. L. H. Garland presided. Members brought films of proven interesting cases for discussion.

An unusual innovation at this meeting was the Therapy Clinic, conducted by Dr. George E. Pfahler. Cases were reviewed in a manner which would demonstrate the proper method of a presentation of therapy cases at a staff meeting. The history and other clinical features of the case were set forth, following which Dr. Pfahler discussed his recommendation for therapy, indicating ports and dosages which he would employ. This was followed by a general discussion of each case. Dr. Allen felt that this was a quite successful venture. There was an enthusiastic audience of eighty, all of whom were reluctant to accept the close of the session.

The Scientific Exhibits were exceptionally good. They were arranged by Dr. E. R. Witwer, Chairman of this committee. Working with him were Dr. Samuel Brown and Dr. Wendell Scott. The first prize was awarded to Lawrence Reynolds, M.D., Kenneth E. Corrigan, Ph.D., H. S. Hayden, Ph.D., and A. J. Derbyshire, Jr., Ph.D., from the Harper Hospital, Detroit, Michigan. Their subject was Biophysical Effects of High Voltage Radiation on the Brains of Experimental Animals. A series of thirty-seven dogs was irradiated. A physical analysis of the nature of the beam and the biologic effect produced was depicted. The application of the petrographic microscope to this type of research was demonstrated. A colored moving picture was shown, which followed these dogs through every stage from the normal, the epileptic-like convulsions after treatment, on through, giving the degree of recovery. This was a beautiful presentation and the award was well deserved.

The Evolution of Dosimeters in Roentgen-ray Therapy, by Otto Glasser, Ph.D., certainly deserves mention. Only one interested in the historical background of a particular science would be able to assemble and prepare such an exhibit. The history of the development of the dosimeters, from the use of the hand, which was the first method for the estimation of quantity and quality of roentgen rays, demonstrating a model of an osteoscope (a variation of the hand method), with the various methods used through the years up to the present time should be of interest to every radiologist.

Dr. Edwin C. Ernst, with his review of roentgenology during the World War, made us realize the marvelous improvement in equipment which has developed since that time. He reviewed the crude equipment with which it was necessary to work and with which they were able to achieve fairly accurate results. The original x-ray plates and the records of almost seventeen thousand examinations made at that time were analyzed.

To make the comparison complete, Major Alfred A. deLorimer, Medical Corps, U. S. Army, Washington, D. C., displayed a splendid exhibit on Wartime Military Roentgenology.

I mention the Bone Tumor Exhibit of Dr. John Murphy because, without doubt, it is the largest and finest and the most complete of this kind that was ever assembled. I doubt if any one of us realizes the enormous amount of work entailed in following such a large number of cases as carefully and as completely as he has done.

Exhibits such as the one on Traumatic Lipo-hemarthrosis of the Knee, by Carleton B. Peirce, M.D., and Douglas C. Eaglesham, M.D.; Cranial Laminography, by Cornelius C. Dyke, M.D.; Multipolar Cell Division as Caused by X-rays, by Paul H. Henshaw, Ph.D.; Laminography in Tuberculosis, by Harry J. Perlberg, M.D., and B. P. Potter, M.D.; Fluororoentgenography in the Gastrointestinal Examination, by Joseph C. R. Root, M.D., and Bernard H. Nichols, M.D.; Intrathoracic Neurogenic Tumors, by Karl Kornblum, M.D., and H. H. Bradshaw, M.D., were all of vast importance to radiologists. It is difficult to refrain from enumerating each scientific exhibitor and his subject. The size of the audience which crowded around the exhibits told the story of their popularity.

The program has been published in RADIOLOGY, and, again, it would be impossible to select outstanding presentations. Many times the rooms available were not large enough for the audience. Out of the entire program, I am going to discuss only the presentation of the Tumor Clinic, on Tuesday morning. Dr. Nichols, in preparing this program, recalled that many times in the past doctors had asked him how to organize and manage a tumor

clinic. He consulted Dr. Lawrence A. Pomeroy, a Director of the Tumor Clinic at the City Hospital, in Cleveland, and he agreed that it would be possible to bring the City Hospital's Tumor Clinic to the Statler Hotel. Under Dr. Pomeroy's capable management, this was done. All of the accessories necessary for the Clinic, such as the fully equipped dressing table, various lights, the x-ray view boxes, and microscopic slide projector, etc., were moved to the hotel. They also brought the patients, nurses, secretary, and social worker. Dr. L. A. Pomeroy and Dr. S. O. Freedlander are the Directors of the Clinic. Dr. J. H. Lazzari is the Executive Secretary of the Clinic and presides at the weekly meetings. The following physicians from the City Hospital presented cases: Hal Freeman, William F. Boukalik, Harvey Mendelsohn, Roy Hildebrand, and J. H. Lazzari. The aim was to present as nearly as possible an accurate session of the regular meeting of the Tumor Clinic. This was not a presentation of cases, as many of our audience seemed to think. The history of each patient was read, and the patient was examined on the platform by the doctor under whose service he belonged. The doctor described his findings to the audience. Photographs, x-ray film, and microscopic slides were shown when possible. The pathologist, Dr. Herbert S. Reichle, added considerable interest to the Clinic as he demonstrated and explained the microscopic slides. There was a general discussion by the staff of the diagnosis, followed by a discussion of the best method of treatment to follow. The final decision as to the management of the case was left to the physician in charge of the case. These cases are brought to the Tumor Clinic from time to time so that the physicians may observe the progress.

Dr. Lazzari, in closing, said that this was their weekly tumor clinic, and the only difference that he could see in holding the meeting at the hotel before such a large audience instead of at the hospital was that the doctors had stage fright and were too polite. Usually there are heated arguments in the discussion of the cases. However, no hard feelings ever result from such discussions.

Twenty companies were represented in the Commercial Exhibits. The members of the Radiological Society appreciate the co-operation of the manufacturers in having the opportunity to study the latest models in roentgenologic equipment.

Throughout the week, the Ladies' Entertainment Committee, headed by Mrs. U. V. Portmann and Mrs. E. P. McNamee, was very busy entertaining the visitors. Those fortunate enough to attend expressed themselves as having had a most enjoyable week.

There was a large attendance at the membership dinner, Monday evening. At the close of the dinner, the Society went into an executive session. This is probably the most important business session of the entire year. At this time, reports are given by all officers, committees, and counselors.

Tuesday evening Dr. Ross Golden gave the Carman Lecture. This Society has honored the memory of Russell Carman for a number of reasons, especially for his contributions to the roentgen interpretations of the pathology of the stomach and gastro-intestinal tract. It was fitting that Dr. Golden, whose subject was Abnormalities of the Small Intestine in Nutritional Disturbances: Some Observations on Their Physiologic Basis, should give this lecture. It was a most scholarly address, and covered every phase of the subject, showing much research and study.

Wednesday evening, the Society was invited to spend "A Day in the Alps." A good dinner was served, followed by dancing and a very elaborate floor show.

Dr. Nichols presided at the annual banquet, on Thursday evening. After the Presidential Address, which, no doubt, will be published in the JOURNAL, we had the opportunity of hearing Dr. Dayton C. Miller, Honorable Professor of Physics at the Case School of Applied Science, speak on the Early Use of the Roentgen Rays. He visited Roentgen in his laboratory within seven months after the discovery of the roentgen rays. He believes that the first surgical x-ray examination in the country was made in Cleveland, and marvels at how quickly the medical profession adapted the new discovery to practical use.

The Committee on Scientific Awards made the following report: Outstanding Exhibits mentioned were: Bone Tumors, by John T. Murphy, M.D., and Clarence E. Hufford, M.D., Toledo, Ohio; The X-ray Treatment of Gas Gangrene and Other Infections, by James F. Kelly, M.D., and D. A. Dowell, M.D., Creighton University, Omaha, Nebr.; Military Roentgenology, 1917–1918, Rouen, France, by Edwin C. Ernst, M.D., St. Louis, Mo., and Evolution of Dosimeters in Roentgen-ray Therapy, by Otto Glasser, Ph.D., Cleveland Clinic Foundation, Cleveland, Ohio.

Honorable Mention was made of the following exhibits: Multipolar Cell Division as Caused by X-rays, by Paul H. Henshaw, Ph.D., National Cancer Institute, Bethesda, Md.; Lipo-hemarthrosis of the Knee, by Carleton B. Peirce, M.D., and Douglas C. Eagleshам, M.D., Royal Victoria Hospital, Montreal, Canada.

First Award went to: Biophysical Effects of High Voltage Radiation on the Brains of Experimental Animals, by Lawrence Reynolds, M.D., Kenneth E. Corrigan, Ph.D., H. S. Hayden, Ph.D. (by invitation), and A. J. Derbyshire, Jr., Ph.D. (by invitation), Harper Hospital, Detroit, Michigan.

Second Award went to R. R. Newell, M.D., San Francisco, for Practical Applications of X-ray Stimulation of the Retina to the Selection of Patients for Cataract Operations and to the Study of Retinal Physiology.

Dr. Leon J. Menville was introduced as the new President-elect. Having served as Editor of RADIOLOGY for a number of years, he was presented with a silver tray by the Executive Committee of the Society, who wished to show, in some way, an appreciation for his very faithful work for many years in the Society. The following officers were then introduced: O. O. Feaster, M.D., St. Petersburg, Fla., First Vice-president; W. E. Costolow, M.D., Los Angeles, Second Vice-president; D. S. Beilin, M.D., Chicago, Third Vice-president; D. S. Childs, M.D., Syracuse, N. Y., Secretary-Treasurer; C. G. Sutherland, M.D., Rochester, Minn., Librarian; H. P. Doub, M.D., Detroit, Mich., Editor; L. G. Allen, M.D., Kansas City, Kan., member of the Executive Committee for four years.

The new President, Dr. W. Walter Wasson, was inducted into office by Dr. Nichols, and, as is customary, was handed the Pfahler Gavel.

Resolutions were passed thanking the local committees for their part in preparing and arranging this unusually splendid Meeting for the members to enjoy.

Z. A. JOHNSTON, M.D.

ANNOUNCEMENTS

REPORT OF THE COMMITTEE ON AWARDS

December 5, 1940

A number of outstanding exhibits at this meeting were necessarily classified as ineligible for an award in spite of unusual educational value and technical excellence. Your Committee found it necessary to adopt certain rules and criteria upon which to base its decisions. Without such rules and criteria selection of particular exhibits for first and second awards would have been impossible.

As outstanding examples of unusually meritorious exhibits which were not considered eligible for awards we call attention to the exhibits on "Bone Tumors," by Dr. Murphy and Dr. Hufford and on "The X-ray Treatment of Gas Gangrene and Other Infections," by Dr. Kelly. No new discoveries or previously unknown facts were contained in these exhibits but the Society owes these men some special type of recognition on account of the extraordinary teaching value which they hold.

Similarly we are indebted to Dr. Ernst and Dr. Glasser for their exhibits entitled, respectively, "Military Roentgenology, 1917–1918," and "Evolution of Dosimeters in Roentgen-ray Therapy." Such historical expositions may not be eligible for an award that is based upon newness of concept and application, but they are none the less important and valuable to our Society.

Basing its judgment, then, upon newness of concept and importance of application, your Committee recommends that the First Award be to Dr. Corrigan, Dr. Reynolds, Dr. Hayden, and Dr. Derbyshire for their exhibit on "The Effects of Radiation on the Brains of Experimental Animals," and that the Second Award be to Dr. Newell for his exhibit on "The Practical Applications of X-ray Stimulation of the Retina to the Selection of Patients for Cataract Operations and to the Study of Retinal Physiology."

Your Committee further recommends that Honorable Mention in the form of Certificates of Merit be awarded to Dr. Paul H. Henshaw for his exhibit on "Multipolar Cell Division as Caused by X-rays" and to Dr. Carleton B. Peirce and Dr. Douglas C. Eaglesham for their exhibit on "Lipo-hemarthrosis of the Knee."

CLINICAL CONFERENCE OF MID-WESTERN RADIOLOGISTS

The Fifth Annual Clinical Conference of Mid-western Radiologists will be held in Rochester, Minn., Feb. 14 and 15, 1941.

AMERICAN COLLEGE OF SURGEONS

The following Sectional Meetings of the American College of Surgeons are announced. Program details will be published later covering the meeting in your area.

Dates	City	Headquarters Hotel	Participating States
March 10 11 12	Minneapolis, Minn.	Nicollet	Minnesota, North and South Dakota, Iowa, Nebraska, Montana, Kansas, Wisconsin; Manitoba
March 17 18 19	Pittsburgh, Penna	William Penn	Pennsylvania, Ohio, Virginia, West Virginia, Delaware, Maryland, New Jersey, New York, District of Columbia
March 26 27 28	Salt Lake City	Utah	Oregon, Washington, California, Nevada, Idaho, Wyoming, New Mexico, Arizona, Colorado, Montana, Utah

Hospital conferences will be held in connection with each of these meetings. Fellows of the College, members of the medical profession at large, and persons interested in the institutional care of the sick and injured are invited to the Sectional Meetings. On the final evening of each meeting, a Meeting on Health Conservation to which the public is invited, will be held.

BOOK REVIEW

DIE ENTZUNDUNGSBESTRAHLUNG (Irradiation of Inflammations). By DR. R. GLAUNER, Lecturer on Roentgenology at the University of Cologne, Chief Physician at the Roentgen and Light Institute of the City Hospital. A volume of 190 pages, with 14 illustrations and 14 tables. Published by Georg Thieme, Leipzig, 1940. Price: 15.00 R.M.

Glauner first reviews the theoretical and experimental basis for the x-ray treatment of inflammatory processes and, to this, he supplements a review of the literature with some experimental work he has done personally. In the second part of the book he takes up the x-radiation of various types of inflammatory disease and gives not only the indications and contra-indications for treatment but the technic of dosage to be used and the results to be expected. Unlike many German authors, Glauner has cited important American works in this field.

The book is probably the best monograph on the subject at present.

IN MEMORIAM

WILLIAM A. EVANS, M.D.

Among the honored pioneers in radiology stands the name of William A. Evans, M.D., of Detroit, Mich., whose death took place in June, 1940. He had extensive experience with the experimental types of x-ray apparatus, and was widely known for his constructive efforts toward the high place which radiology holds to-day among the medical specialties.

Most intimately identified with the American Roentgen Ray Society through his long period as Treasurer of that Society, Dr. Evans was yet high in the confidence of members of many societies. He was a physician of the highest attainments, and his passing is a genuine loss to radiology.

ABSTRACTS OF CURRENT LITERATURE

CONTENTS BY SUBJECT

THE FOLLOWING ABSTRACTORS HAVE CONTRIBUTED TO THIS ISSUE

S. M. Atkins, M.D., of Waterbury, Conn.
S. R. Beatty, M.D., of Oshkosh, Wisc.
J. J. Clark, M.D., of Atlanta, Ga.
Q. B. Coray, M.D., of Salt Lake City, Utah
Percy J. Delano, M.D., of Chicago
Sydney J. Hawley, M.D., of Danville, Penna.
Lewis G. Jacobs, M.D., of Winona, Minn.
Eugene T. Leddy, M.D., of Rochester, Minn.
Antonio Mayoral, M.D., of New Orleans, La.
Lester W. Paul, M.D., of Madison, Wisc.
Ernst A. Pohle, M.D., Ph.D., of Madison, Wisc.
Simon Pollack, M.D., of Tulsa, Okla.
Ernst A. Schmidt, M.D., of Denver, Colo.
Charles G. Sutherland, M.D., of Rochester, Minn.

ABSTRACTS IN THIS ISSUE LISTED ALPHABETICALLY

CANCER

Epidermoid Carcinoma of the Pharynx, Buccal Mucosa, and Larynx. D. M. Lierle. Ann. Otol., Rhinol., and Laryngol., **48,** 875–885, December, 1939.

A statistical report of 169 cases of epidermoid carcinoma involving the buccal mucosa, pharynx, and larynx is presented. The patients had been observed over periods of from three to seven years. The analysis is presented in the form of a series of tables. Of 26 cases of carcinoma of the larynx treated with irradiation, only two are alive after three and four years, respectively. These were, for the most part, advanced cases with no treatment possible except irradiation. Ten selected cases were treated surgically and all but one are still living after six to eight years. Of 17 cases of carcinoma of the pharynx, all treated by irradiation, only one has survived. All of these lesions were extensive and inoperable at the time of first observation, and metastases were present in 82 per cent. Eighteen cases of epidermoid carcinoma of the tonsil were treated, all except two by irradiation alone and, of these, only two are alive for three and seven years, respectively. Of 16 cases of carcinoma of the alveolar process, five, or 31 per cent, were alive from three to seven years following treatment. A combination of surgery and irradiation seemed best in cases of this type. Four cases of involvement of the tongue out of a total of 23 were alive after from three to four years, all treated by radiation methods. The author concludes that well localized, differentiated lesions, for the present, at least, respond better to surgical methods or to a combination of surgery and irradiation than to irradiation alone. Advanced cancers and undifferentiated tumors do not respond well to any treatment but irradiation offers hope of palliation and life may be prolonged for months or years. Education in the early recognition of cancer is one of the most important problems to be solved.

LESTER W. PAUL, M.D.

A Contribution to the Knowledge of Primary Duodenal Cancer. Asta Bergendal. Acta Radiol., **20,** 417–426, November, 1939.

The author reports two cases of primary cancer of the duodenum diagnosed roentgenologically. The roentgen diagnosis in the first case was confirmed by operation and biopsy, in the second case by autopsy. In the first case the x-ray examination showed marked stenosis of the infra-ampullar lumen of the duodenum with signs of stasis above the scirrhous stricture. The stenosis was visualized with the patient in the lateral position. As etiologic factor for the narrowing, strangulation of the mesenteric vessels was also considered. One and a half years after operation this patient was still free of symptoms.

In the second case, the lower portion of the duodenum was involved, and there existed a stasis in the descending portion. By means of small quantities of a thick barium meal, it was possible to outline the tumor infiltration in contrast to the normal mucosal pattern of the surrounding areas. The autopsy revealed that the tumor mass had spread to the adjacent parts of the head of the pancreas.

ERNST A. SCHMIDT, M.D.

The Cancer Problem from the Point of View of the Public Health Service. W. M. Frazer. British Jour. Radiol., **12,** 518–522, September, 1939.

The results in the treatment of cancer by the best methods or combination of methods now known is unsatisfactory. Two lines of advance that should be followed up while waiting for more definite knowledge about the cause and cure of cancer are relief of pain and earlier diagnosis. Early diagnosis must always remain an essential factor in successful treatment. This presents administrative problems. Even regular examination of those in the cancer age does not succeed. Cancer clinics have been tried but with little success.

In 1939, Parliament passed the Cancer Act which requires counties and boroughs to see that there are adequate facilities in their territories for the care of patients suffering from cancer. Whatever arrangements are made must be approved by the Minister of Health. Small communities may send their patients to nearby larger centers. The number of centers where radium and x-ray will be available are expected to increase and many patients who have not been able to get radiation therapy will be so able later on.

Voluntary hospitals already established will be able to take care of many of the patients without additional cost to themselves. If expansion of the hospital is necessary, it will be taken care of by a grant under the act.

SYDNEY J. HAWLEY, M.D.

Cancer from the Point of View of the Surgeon. Sir Robert Kelly. British Jour. Radiol., **12,** 523–525, September, 1939.

The surgical treatment of cancer has not progressed in 35 years in cancer of the breast, gastro-intestinal tract, or osteogenic sarcoma. It has become less radical in buccal and uterine cancer.

There are several questions connected with cancer that are not yet answered. Why is cancer of the lip more frequently on the lower lip? How far do the lymphatic glands fix cancer cells? What is the proper interval between treatment of the primary and secondary growths if they cannot be removed at the same time? In a biopsy, is it safer to cut into or to cut out the growth? Should diathermy be used? What gives some individuals immunity from cancer? Why do gastric carcinomas spread beyond the symptoms? What accounts for the multiplicity of cancer in x-ray workers, in tar workers? There are many other similar questions.

Early diagnosis is essential but is not always possible. What we need is a perfect test for cancer.

SYDNEY J. HAWLEY, M.D.

Cancer from the Point of View of the Radiotherapist. Ralston Paterson. British Jour. Radiol., **12,** 526–531, September, 1939.

Radiation therapy may be given with the object of palliation or of cure. Cure may be attempted when the lesion is of a sensitive type and is located where an adequate dose may be given. If curative therapy fails, palliation may result. If palliation is the object of treatment, the reactions of curative therapy are not justified. Palliation may be undertaken for the prolongation of life, the relief of distressing symptoms, the temporary arrest of the growth, and for its psychologic effect.

The choice of radiation or surgery should not be difficult. Only such surgical procedures as colostomy and gastrostomy are palliative. Only four types of cancer can be regarded as curable: breast, mouth and lip, skin, uterus and cervix. Of these, the breast cancers are the only ones that are best handled by surgery.

Radiation therapy is contra-indicated in osteogenic sarcoma, fibrosarcoma, and other adult mesoblastic sarcoma, carcinoma of the stomach, intestine, colon, secondary carcinoma of the liver, secondary carcinoma of the lung, advanced cancer with cachexia, with multiple metastases, and advanced carcinoma in the absence of symptoms.

Radiation therapy is indicated but of limited value in cancer of the rectum, hypernephroma, carcinoma of the ovary, cerebral tumors, carcinoma of the larynx, bladder, prostate, thyroid, salivary glands, pharynx, esophagus, lung, malignant mediastinal tumors, isolated metastases in bone, and inoperable adult sarcoma.

In the following cases surgical extirpation and radiation therapy are both of value: cancer of the breast, secondary cancer of the lymph nodes, cancer of the body of the uterus, vulva, penis and scrotum, skin, giant-cell tumor of bone, and mixed tumors of the parotid.

Radiation is the treatment of choice in seminoma testis, embryonal tumors of the ovary, Wilms' tumors, some tumors of the thyroid, salivary glands, and nasal sinuses, leukemia, Hodgkin's disease, lymphosarcoma, thymoma, Ewing's tumor, endothelioma of vascular origin, and carcinoma of the mouth, skin, cervix, vagina, anus, bladder (if limited), and maxillary antrum.

SYDNEY J. HAWLEY, M.D.

The Cancer Problem from the Point of View of the Physician. Henry Cohen. British Jour. Radiol., **12,** 532–535, September, 1939.

At present the treatment of cancer is almost wholly anatomic. The physician's first duty then is to recognize the disease in its earliest stages when it is most amenable to anatomic treatment. He must also recognize the predisposing causes and remove them.

Our knowledge of the physiology of cancer cells is increasing and may lead to treatment by modification of function so that disease processes may be arrested or nullified. Antipathogens of the type of salvarsan in syphilis may be found.

Why does a patient develop cancer? Experience has shown that senility is not a direct cause. Physical agencies like radium will produce cancer after long application. Similarly, cancer develops in points of chronic irritation, like leukoplakia, after the passage of time. Some change occurs in the cells which causes the change from normal cells to malignant. There is some evidence, particularly the work of Peyton-Rous, to show that this may be a virus. The problem is not simple, as it appears that other factors than just the virus are necessary. There is a great difference in the susceptibility of some animals and of certain individuals. This susceptibility appears to be an hereditary tendency.

SYDNEY J. HAWLEY, M.D.

THE CHEST

Landmarks in Simple Pleural Effusions. Julius Kaunitz. Jour. Am. Med. Assn., **113,** 1312–1314, Sept. 30, 1939.

Before the advent of the x-ray many clinicians described the upper level of effusions as curved or straight, depending entirely on the upper margin of the percussion note.

Following the removal of 10 c.c. of pleural effusion an equal volume of a combination of iodized poppyseed oil and cajuput oil was injected. The oil immediately floated to the top. This created three radiographic zones: (1) a radiopaque zone, the area below the lung, visualized as a dense shadow; (2) a radiotranslucent zone, the area between the lung and the chest wall, seen as a hazy shadow but dense in the lateral aspect; (3) a radiotransparent zone, the area of liquid between the lung and chest wall, too thin to cast a shadow except in the lateral aspect.

With the three zones as a landmark, it was possible with a greater degree of accuracy to choose the site for thoracentesis.

CHARLES G. SUTHERLAND, M.D.

Pseudo-diaphragmatic Shadow Due to Pleural Fluid. Oscar Lipschultz. Minnesota Med., **22,** 638–641, September, 1939.

Occasionally free fluid in the pleural cavity will gravitate to the inferior-most portion of the pleural cavity and insert itself between the inferior surface of the lung and the diaphragm. Thus, the superior surface of the fluid in contrast with the aerated lung gives the impression of an elevated diaphragm, as compared to the usual distribution, in which the fluid is seen in the lateral periphery of the lung as a ribbon-like shadow in the axillary line.

Fluid which has been present for some time becomes frequently fixed, so that change in body position does not cause a shift.

Roentgenograms of the chest in which the fluid is atypically located give an erroneous idea of an elevated diaphragm. The diaphragm also appears elevated in fluoroscopy. On inspiration, movement of the pseudodiaphragm is quite normal in appearance. In all the

author's cases this sort of accumulation was on the right. If the fluid is not encapsulated, the shift may be demonstrated with the patient in the supine position.

The author concludes that fluid in the pleural cavity usually accumulates in its most dependent portion with an upper level which extends obliquely medialward and downward, the usual distribution being due to hydrostatic pressure, capillarity of the pleura, elasticity of the lung, and the negative intrapleural pressure. A change in the elasticity of the lung will cause fluid to arrange itself atypically so as to simulate a high diaphragm. Fluoroscopic or film study with the patient in a supine position, as an adjunct to the usual film in the upright position, will generally bring the condition to light.

PERCY J. DELANO, M.D.

The Bronchoscopist and the Thoracic Surgery Team. M. F. Arbuckle and A. C. Stutsman. Jour. Am. Med. Assn., **113,** 1394–1400, Oct. 7, 1939.

As a result of their experience and from conversation with men from other centers, the authors were convinced that the most successful operations on the chest were accomplished as a result of teamwork by a group of men, each a specialist in his own field, who collaborate in each case in establishing the diagnosis and in outlining and administering treatment. Such a group properly consists of an internist who is especially interested in thoracic disorders, a thoracic surgeon who is a specialist in this field by reason of actual and thorough training, a bronchoscopist similarly qualified, an expert radiologist, a pathologist, and a bacteriologist.

Most pulmonary disorders may be discovered and recognized by means of x-ray and physical study, but they may be much more accurately localized and their exact nature may be more definitely established by visual examination through the bronchoscope and the study of specimens obtained during the examination.

Bronchograms made by bronchoscopic introduction of the oil will be far more satisfactory if the operating room is equipped with adequate x-ray apparatus and if the tube is focussed before the oil is put in, so that the exposure may be made before the position of the oil is disturbed by coughing.

Bronchoscopic approach is extremely valuable in the treatment of certain varieties of pulmonary disorder, prominent among which are lung abscess and localized tuberculous lesions.

CHARLES G. SUTHERLAND, M.D.

THE DIAPHRAGM

Question of Hiatus Hernia. E. Biro. Schweiz. med. Wchnschr., **69,** 830–832, Sept. 16, 1939.

The author studied five cases of hiatus hernia, and on the basis of these concluded that anomalous conditions about the hiatal orifice are not, in themselves, a cause of symptoms, but produce a predisposition to them. The diagnosis is always made by the use of contrast media, and one must differentiate supraphrenic diverticula. So far as therapy goes, Bergman employed exercises and carbon dioxide; the author had good early results in one case with operation. The possibility of good results from a left-sided phrenic exeresis cannot be ignored.

LEWIS G. JACOBS, M.D.

Congenital Absence of the Left Leaf of the Diaphragm. V. Fanano. Riv. di pat. e clin. d. tuberc., **8,** 576–583, August, 1939.

The author reports a case of an eight-year-old child in whom the left leaf of the diaphragm was congenitally absent. The patient had no symptoms attributable to the deformity. Her mother had sought medical aid for the child because for some time previously the child had suffered from annoying eructation and had vomited about one hour after meals. However, if she remained recumbent after meals she would not vomit.

Roentgenologic study of the chest revealed opacity of the left lower lobe, suggesting pleurisy with effusion; clinically, however, the signs of fluid were not found. Because of the discrepancy of the findings, the patient was hospitalized and further investigation was made, employing a barium enema. This examination revealed that the greater portion of the left chest was occupied by the colon.

The author reviews the embryology of the diaphragm and points out that the differential diagnosis between this condition and intrathoracic stomach, large cavity at the base of the left lung, diverticula of the diaphragm or of the esophagus, diaphragmatic hernia, or eventration must be made.

ANTONIO MAYORAL, M.D.

DOSAGE

Problems of Dosimetry in Pendulum Therapy. E. Günsel. Strahlentherapie, **65,** 639–648, 1939.

The author carried out a series of measurements in order to establish isodose curves and percentage depth dose for a tube which is rotating during the exposure. He used 190 kv., 15 ma., 0.75 mm. Cu + 0.5 mm. Al, H.V.L. in Cu 1.25 mm., 30 r/min., at 50 cm. F.S.D., speed of the pendulum 0.15 min. per angle degree, choosing a pendulum angle of 180 degrees with an exposure time of 27 minutes. The results are shown in five graphs. The author concludes that this new technic of therapy offers definite advantages in the treatment of deep-seated cancers.

ERNST A. POHLE, M.D., Ph.D.

Short Distance Low Voltage X-ray Therapy. Philip A. Flood and D. Waldron Smithers. British Jour. Radiol., **12,** 462–485, August, 1939.

The advantages of this kind of treatment are: the energy is absorbed in a small volume of tissue, the rate of dosage is high, and the cost is low.

The dosage may be based on the experience with previous cases or on the immediate tumor response. It may be given in one sitting or fractionated. The "x-ray caustic" method of van der Plaats has these disad-

vantages: the tumor thickness must be measured to within a millimeter or two and with gross over-dosage of a small volume of tissue there is a possibility of late necrosis. The authors' method is to use fractional doses except in small lesions, in which cases a single massive dose is given. Each individual treatment is carefully calculated so that there is no over- or under-dosage at the edge and the maximum and minimum tumor dose are as near together as possible. The usual daily dose is from 600 to 800 r. For rodent ulcers, a minimum tumor dose of from 4,500 to 5,000 r is given, for epitheliomas, from 6,000 to 7,000 r, and rarely over 8,000 r in from 10 to 21 days. Large, irregularly shaped tumors are treated in multiple fields. Double overlapping often occurs, but triple overlapping is avoided if possible. Occasionally, as in lip tumors, two opposite fields are used.

Of 65 cases of rodent ulcer which had not been previously treated, 96.9 per cent were free from recurrence during observations from six months to three years. Of 46 patients with epithelioma of the skin, 78.3 per cent were alive with no sign of recurrence. In 21 cases of epithelioma of the lip, the primary lesion healed with no sign of local recurrence in 85.7 per cent.

This method of treatment has been successful in the local treatment of recurrent nodules after amputation of the breast. Pitch warts, simple warts, keloids, cavernous nevi, and corns respond well. Malignant melanoma and leukoplakia do not respond satisfactorily. The method has been used for cancer of the bladder through a suprapubic wound and for cancer of the rectum, with encouraging results. One patient with cancer of the lung was treated after surgical exposure of the tumor.

SYDNEY J. HAWLEY, M.D.

A Rapid and Convenient Method of Checking the Kilovoltage in X-ray Therapy. D. E. A. Jones. British Jour. Radiol., **12,** 554–558, September, 1939.

A marked change in the output of a generator and tube may take place without any apparent change in the operating conditions. This change is often due to change in the voltage. Such changes may be discovered by repeated half value layer determinations but this is rather time-consuming.

Once the half value layer of a given beam has been determined, a filter of the thickness of the half value layer may be made. Measurements made with and without this filter will determine variations in the kilovoltage of about 15 kv.

Changes of about 10 kv. may be discovered by the "quality ratio" method. Determinations of the intensity with two different filters are made, such as 3 mm. Al and Thoraeus. This ratio is the "quality ratio." Once this ratio is determined for various voltages, it is reasonably accurate for the determination of voltage changes in the same machine or different machines.

SYDNEY J. HAWLEY, M.D.

FOREIGN BODIES

A Series of 200 Cases of Esophagoscopy for Foreign Bodies. F. G. Wrigley. British Med. Jour., **2,** 334, 335, Aug. 12, 1939.

The author points out the advisability of esophagoscopy in all cases of suspected foreign body in which the radiologist is unable to give an absolutely negative report. In 180 of the 200 cases reported, a foreign body was found and removed. The two deaths which occurred were due to perforation and infection. Age groups are given, the period of highest incidence being from six to ten years.

Q. B. CORAY, M.D.

A Rare Case of Foreign Body Tolerance in the Pericardium. A. P. Bogicevic. Radiol. Glasnik, **3,** 57–60, June, 1939.

The author describes the case of a 45-year-old man in whom an incidental x-ray examination after an accident revealed the presence of a rifle bullet in the pericardium. The bullet had apparently occupied the same position for about sixteen years, without producing any symptoms.

ERNST A. SCHMIDT, M.D.

The Diagnosis and Treatment of Aspirated Foreign Bodies. H. Zschau. München. med. Wchnschr., **86,** 1478, 1479, Oct. 6, 1939.

A case of a man who sustained a severe skull fracture in an automobile accident, followed by pulmonary symptoms, is reported. After 16 months' delay, a roentgenogram of the chest was made, and showed collapse of the right lower lobe due to an inhaled tooth. Two unsuccessful attempts at removal by bronchoscopy were followed by a third successful attempt four years after the accident. The patient's symptoms (due to abscess and bronchiectasis) greatly improved, but slight residua were present after 10 months. The author points out the obvious moral: the early employment of roentgen studies and the insistence on immediate bronchoscopic removal of the foreign body, as the hopes of spontaneous expulsion are *nil*. Some sound but not particularly new discussion of the diagnostic difficulties encountered in roentgen examination is included.

LEWIS G. JACOBS, M.D.

Procedure and Apparatus for Optical Guidance of the Extraction of Projectiles Localized by Radioscopy. André Chéron. Bull. et mém. Soc. de radiol. méd. de France, **27,** 83–87, February, 1939.

The apparatus designed by the author depends on the fact that the image of a luminous point fixed at a given distance above a horizontal glass plate will appear to lie at a point exactly the same distance *below* the glass and in the same vertical projection when a person with stereoscopic vision looks through the glass from above.

The apparatus includes a fixed point of light, 25 cm. above a horizontal plate of clear glass. A fluorescent

screen, having a small bit of lead placed in the center exactly below the light in the vertical planes, may be introduced below the glass plate.

The depth of the foreign body below the skin is determined by conventional methods of measurement and a mark is placed on the skin directly above it. The apparatus is then placed above the mark so that it, the center of the plate, and the light are in line vertically and the distance from the foreign body to the glass plate is 25 cm.

To the observer looking downward through the glass plate, the light will appear to be in the exact location of the foreign body as though seen through the flesh.

The fluorescent screen aids in re-alignment if this is necessary.

S. R. BEATTY, M.D.

FRACTURES

Suggestions for the Radiodiagnosis of Fractures of the Labyrinth: Medico-legal Importance. C. Chaussé. British Jour. Radiol., **12,** 536–546, September, 1939.

Fractures of the labyrinth are commonly longitudinal, transverse, or oblique: (1) The longitudinal ones are parallel to the petrous axis and the result of trauma to the temperoparietal region. The tympanum is usually torn. Facial paralysis is rare. (2) Transverse fractures have the fracture perpendicular to the axis and result from trauma in the occipital or occipito-mastoid region. The internal ear is usually destroyed. Facial paralysis is frequent. (3) Oblique fractures result from blows on the occiput and combine the dangers of both the other types.

Coma may or may not be present. Otorrhagia is usually immediate and profuse. Cerebrospinal fluid leakage and extrusion of brain substance are rare. Facial paralysis may be immediate or delayed. Acoustic trouble may be delayed. The risk of meningeal complication is greater with oblique fractures.

Labyrinthine fractures often do not heal with bony union. Infection may find its way into the meninges years later through the fracture line.

For the diagnosis of the fractures, roentgenographic views must be taken from various angles. The details of the technic are given in a diagram and illustrated with several cases.

SYDNEY J. HAWLEY, M.D.

The Principles of Fracture Treatment. Charles L. Scudder. Minnesota Med., **22,** 667–670, October, 1939.

Scudder stresses the importance of fundamentals; the treatment of a fracture begins when the fracture happens, and continues until the patient returns to work. The idea that anybody can treat a fracture is less prevalent than it used to be. The physician must first decide whether or not he is competent to treat the fracture in any given case. If in doubt, have consultation.

Always transport suspected and actual fractures in fixed traction. Unless profound shock is present, an x-ray film should be made. Associated injuries must be looked for—lung and pleural lesions, visceral lesions, rupture of urethra and bladder after pelvic fracture, cerebral damage beneath the vault of the cranium.

The procedures available in the non-operative treatment of fractures are: (1) traction and counter-traction; (2) manipulation; (3) pressure and counter-pressure; (4) leverage, and (5) rotation.

The operative treatment of fractures has a wider scope to-day than ever before, owing to greater appreciation of the pathology of repair, greater operating-room facilities, and asepsis. It is now a safe and sound treatment, no longer a method of last resort.

PERCY J. DELANO, M.D.

GAS GANGRENE

Gas Gangrene: An Analysis of 34 Cases Treated in the Past Five Years in San Francisco Hospital, with Special Reference to Roentgen-ray Therapy. A. Justin Williams and Homer V. Hartzell. Western Jour. Surg., Obst. and Gynec., **47,** 561–565, October, 1939.

The authors analyze a group of 34 cases of gas gangrene, in which the first 17 cases, from 1935 to 1937, were treated by serum, amputation, Dakin's irrigations, etc., and the latter 17, from 1937 to 1939, were given x-ray therapy.

Traumatic Case Group	No. Cases	Fatalities	Percentage Cured
Without x-ray	12	7	58.3
With x-ray	12	1	8.3

Eight cases, all of whom died of arteriosclerotic gangrene complicated by gas gangrene , are included; four of these were not treated with roentgen ray, four were. The four treated with x-ray showed no evidence of gas gangrene as the cause of death; two had pulmonary emboli, one pneumonia, and the last in this series had arteriosclerotic heart disease which caused death. The authors stress the importance in x-ray studies of gas shadows in the soft tissues as the prime diagnostic criterion for gas gangrene.

The therapy technic used is not given in detail, but the writers advise one exposure every 12 hours for the first three days.

SIMON POLLACK, M.D.

Treatment of Gas Gangrene. E. P. McNamee and C. R. Lulenski. Ohio St. Med. Jour., **35,** 1062–1065, October, 1939.

On the basis of Kelly's very favorable reports on the use of repeated small doses of low voltage x-ray in gas gangrene infection, the authors' report on nine cases so treated. Beside the usual supportive measures and the administration of 2,000 c.c. gas bacillus and 1,500 c.c. antitetanic serum, the authors administered 100 r to the whole area involved once a day for four days. The factors used were: 89 kv., 5 ma., 2 mm. Al filter, H.V.L. 3 mm. Al, from 12 to 14 inch target–skin distance. The field extended well beyond the area of involvement. With trunk involvement, 140 kv. was used.

Of the nine patients treated—all of whom had positive cultures for gas bacillus—seven were post-traumatic and two followed amputations for arteriosclerotic or diabetic gangrene. Seven cases recovered. One of the deaths, in a 29-year-old male, was caused by a complicating septicemia and bronchopneumonia two weeks after disarticulation of the injured arm, but there was no evidence of gas bacillus infection at postmortem examination. The other fatality was in a case following amputation for arteriosclerotic gangrene. The experience in the same hospital without x-ray therapy showed a mortality of four out of nine cases treated conservatively from 1930 to 1936.

SIMON POLLACK, M.D.

GYNECOLOGY AND OBSTETRICS

The Application of Radium and Roentgen Rays in Gynecology, in the Light of the Genetic Effects of Radiation. J. H. Müller. Schweiz. med. Wchnschr., **69**, 849, 850, Sept. 23, 1939.

The author points out that a marked increase in the mutation rate has been experimentally proven to result from irradiation in experimental animals and plants; this is of the order of 0.0001 per cent for single mutation occurrences, and about 1 per cent for a summation of mutations. There are three types of mutation described by Timoféeff-Ressovsky: (*a*) gene mutations, with change in structure of a single gene; (b) chromosome mutations, with a change in the number or position of the genes within the chromosome, and (*c*) "genommutations," in which neither the single genes nor the chromosomes are changed, but the number or arrangement of the chromosomes is altered. Most of the mutations lead to death in the offspring. In view of this evidence, the therapeutic use of irradiation must be sharply delimited; the employment in cancer or for permanent sterilization is permissible, but the wisdom of the use for temporary sterilization, in juvenile metropathies, and for abortion in which conception will subsequently be permitted, is dubious.

Since the depth effect in radiography may reach from 3 to 8 r per plate, or from 8 to 10 r/min. in fluoroscopy, study of the abdomen should be limited by this consideration, as a dose of about 100 r is known to double the mutation rate. In the same manner, since it is possible to acquire a genetically dangerous dose without exceeding the accepted general tolerance limits, one should use caution in protecting the x-ray department personnel. The tolerance dose should probably be reduced to 10^{-8} r/sec. to avoid danger.

LEWIS G. JACOBS, M.D.

A Radiographic Demonstration of the Circulation through the Heart in the Adult and in the Fetus and the Identification of the Ductus Arteriosus. A. E. Barclay, Sir Joseph Barcroft, D. H. Barron, and K. J. Franklin. British Jour. Radiol., **12**, 505–517, September, 1939.

The circulation through the heart of the adult and fetal sheep, cats, and rabbits was studied by serial and cinematic radiography after the injection of various opaque media. These studies show that in the adult, the venous blood passes through the right heart, the lungs, the left heart into the systemic circulation. In the fetus, the blood from the superior vena cava passes through the right heart into the pulmonary trunk where it divides, part going to the lungs and part through the ductus arteriosus into the aorta. Most of the blood from the inferior vena cava goes through the foramen ovale into the left heart while the smaller part takes the usual course into the right heart to the pulmonary aorta, then through the ductus arteriosus into the aorta. These results are excellently illustrated by films and diagrams.

According to the results, the ductus arteriosus closes functionally shortly after delivery.

SYDNEY J. HAWLEY, M.D.

Irradiation with Small Doses in the Treatment of Functional Gynecological Conditions. Ira I. Kaplan. Am. Jour. Roentgenol. and Rad. Ther., **42**, 731–744, November, 1939.

Roentgen therapy has proven effective in many cases of functional disturbances of the ovary and in sterility. Amenorrhea, when due to functional disturbances, is also amenable to roentgen therapy. These conclusions are drawn not only from reports published in 1930 and 1931, but also from a later group composed of 194 patients, all of whom had previously had some form of endocrine therapy without results, and had been examined for gynecologic abnormalities. Many had had previous tubal insufflations or some surgical corrective measure or curettage without relief.

Whether the roentgen irradiation directly affects the ovary, uterus, or pituitary or is an indefinite endocrinologic factor stimulant is debatable. The technic used was as follows: 200 kv., 4 ma., 0.5 mm. Cu plus 1 mm. Al filter, with a target distance of 30 to 40 cm. Treatment was directed through anterior and posterior right and left pelvic fields of 9 × 15 cm., and to the pituitary through 6 × 8 cm. fields. The dose given was from 75 to 150 r (measured in air) per field, at weekly intervals, for three weeks. The anterior pelvis was treated the first week, the posterior pelvis the second week, and the anterior the third. Occasionally a fourth treatment was given. The pituitary was treated at the same session as the anterior pelvis.

The pelvis was treated in all cases and the pituitary in 104. In six cases the thyroid also was treated.

Of the 103 patients whose menstruation was re-established, 51 became pregnant and the children born disclosed no abnormalities at birth or later. The oldest child is now 12 years of age. None of the patients treated was harmed in any way, and in no instance was there cessation of menstruation which had previously occurred in the usual manner. Many cases are cited.

S. M. ATKINS, M.D.

Carcinoma of the Uterus and Ovarian Function. F. Gál. Strahlentherapie, **66**, 570, 1939.

The author investigated the relationship between

ovarian function and carcinoma of the genital organs, analyzing for that purpose the histories of 1,175 patients seen in his clinic during a decade. It appeared that the percentage of cures was much higher in women over 45 years of age. In the cases which were operated on the percentage of recurrence was high if the ovaries had been removed. Were they left in and then sterilized by irradiation the end-results were definitely improved. Post-operative irradiation did not increase the percentage of cures in patients who had a complete hysterectomy. Although no final conclusions can be drawn yet, there seems little doubt regarding the influence of ovarian function on cancer.

ERNST A. POHLE, M.D., Ph.D.

Roentgenologic Visualization of the Soft Tissues in Pregnancy. William Snow and Meyer Rosensohn. Am. Jour. Roentgenol. and Rad. Ther., **42,** 709–717, November, 1939.

The site of the placenta, placenta previa, central and partial premature separation, extra-uterine pregnancy, and some tumors causing dystocia have been demonstrated by roentgen examination. This is accomplished by either flat films or films made after injecting the bladder or even the rectum with air.

The placenta can be seen in the routine roentgen examination of pregnancy, in the late stages, as a soft-tissue density occupying about one-third of the wall space of the uterine cavity. It is best seen on the lateral film. It bulges in the middle and tapers off toward the uterine wall, and almost invariably faces the small parts.

In placenta previa, the bladder is injected with 150 c.c. of air and anteroposterior and lateral views are made. With central placenta previa, a soft-tissue shadow will be cast between the fetal skull and the urinary bladder.

In placental apoplexy, a localized bulge of the uterine wall can be seen on the roentgenogram, although fibroids may give the same findings.

The amniotic sac usually is not differentiated, but in polyhydramnios a wide shadow is seen all around the fetus and a disproportion between the size of uterus and fetus. Extra-uterine pregnancy shows fetal parts lateral to the uterus.

S. M. ATKINS, M.D.

Sterilization by Irradiation. A. Pickhan. Strahlentherapie, **66,** 561, 1939.

The author briefly discusses the German laws covering sterilization. He then relates his experience with castration by irradiation in nine psychic cases. The average dose effective in the ovaries was 280 r; two sittings on two successive days were given through two abdominal fields (180 kv., 1 mm. Cu). The results were satisfactory; in seven patients with genuine psychosis radiation therapy had a beneficial effect on the mental condition. In view of the possibility of pregnancy after sterilization by roentgen rays the author urges great caution in their use. The sterilization of males by irradiation is, in his opinion, inadvisable.

ERNST A. POHLE, M.D., Ph.D.

Sterilization by Irradiation. C. J. Gauss. Strahlentherapie, **66,** 545, 1939.

According to German law, sterilization for the prevention of abnormal offspring can be performed only by operation in males, while in women over 38 years of age and in younger women, if surgery is contra-indicated, irradiation by means of x-ray or radium is also permissible. The author sent a questionnaire to the 140 clinics which are licensed to sterilize by irradiation, in order to get some definite idea as to the methods used, the results obtained, and ill effects obtained, if any. The statistical analysis is presented in 14 tables which should be looked up in the original. It appeared that 75 per cent of irradiated women were over 38 years old. Most clinics seem to prefer fractional doses; the number of failures is very small. Roentgen therapy is to be given preference because there is no mortality, no anesthetic, and a very short stay in the hospital—if any hospitalization at all is required.

ERNST A. POHLE, M.D., Ph.D.

HERNIA, DIAPHRAGMATIC

Right-sided Traumatic Diaphragmatic Hernia. F. Fiumicelli. Arch. di radiol., **15,** 496–503, July–October, 1939.

The author has been unable to find a report of a case similar to the one he reports, which occurred in a child seven years of age, whose hernia was studied 25 days after he was run over.

EUGENE T. LEDDY, M.D.

Diaphragmatic Hernia: Results of Surgical Treatment in 210 Cases. Stuart W. Harrington. California and West. Med., **51,** 27–31, July, 1939.

In the June and July issues of this journal, the author discussed diaphragmatic hernia and the results he obtained from surgical treatment. This is a very thorough discussion and is probably of more interest to surgeons than to radiologists; however, as the radiologist usually makes the diagnosis, he should be familiar with the surgical results in this type of case.

JAMES J. CLARK, M.D.